MAY 1934

ELECTRICAL WORLD

May 19, 1934

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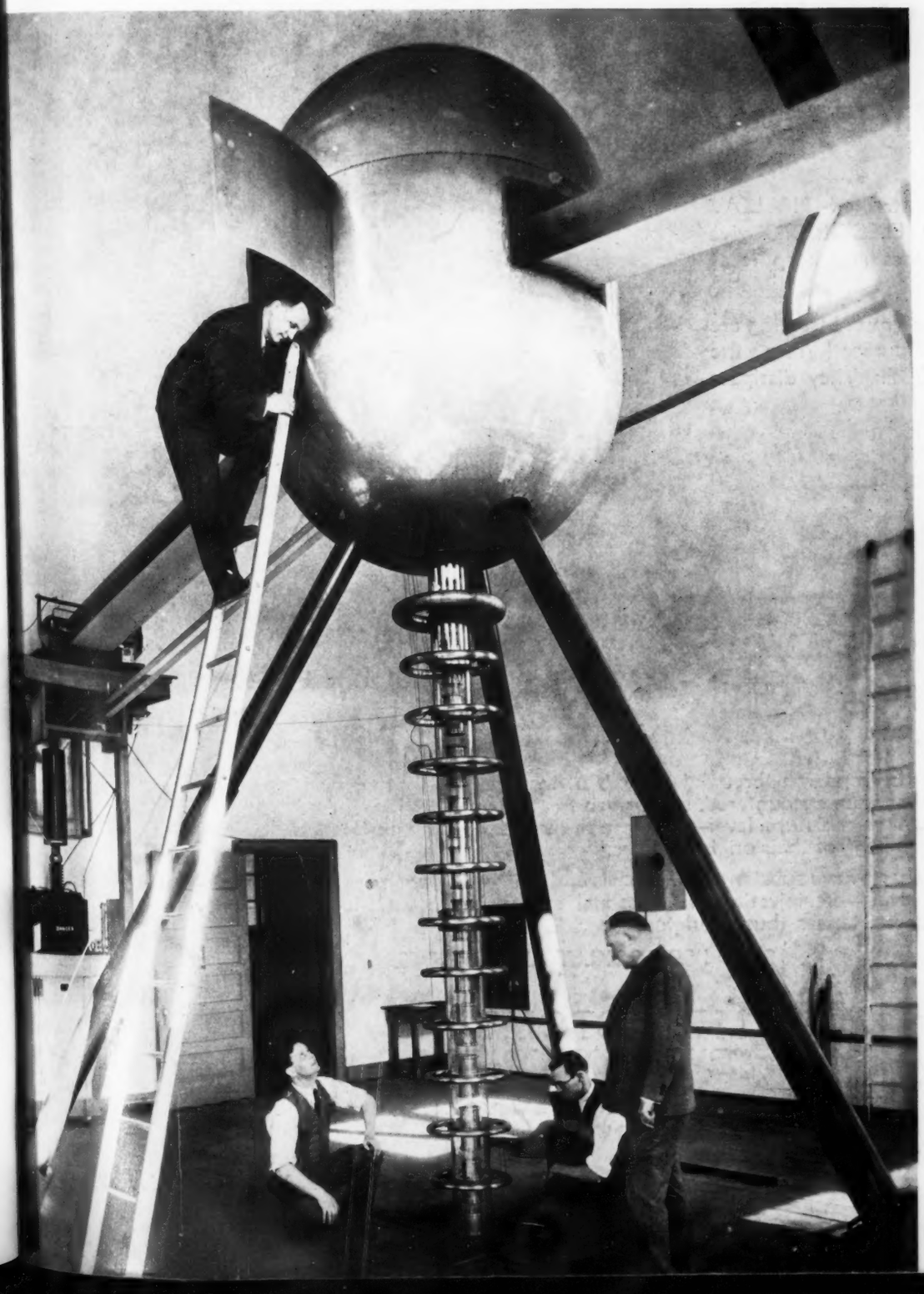

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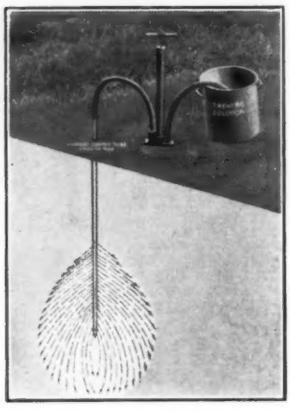

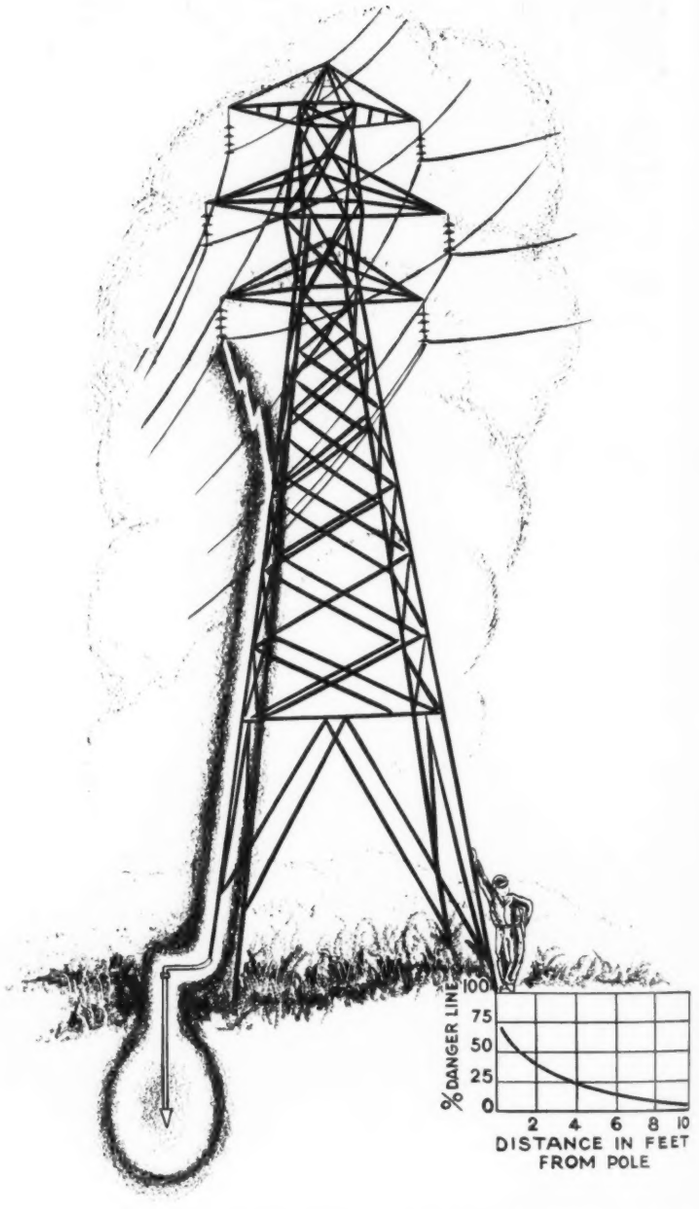

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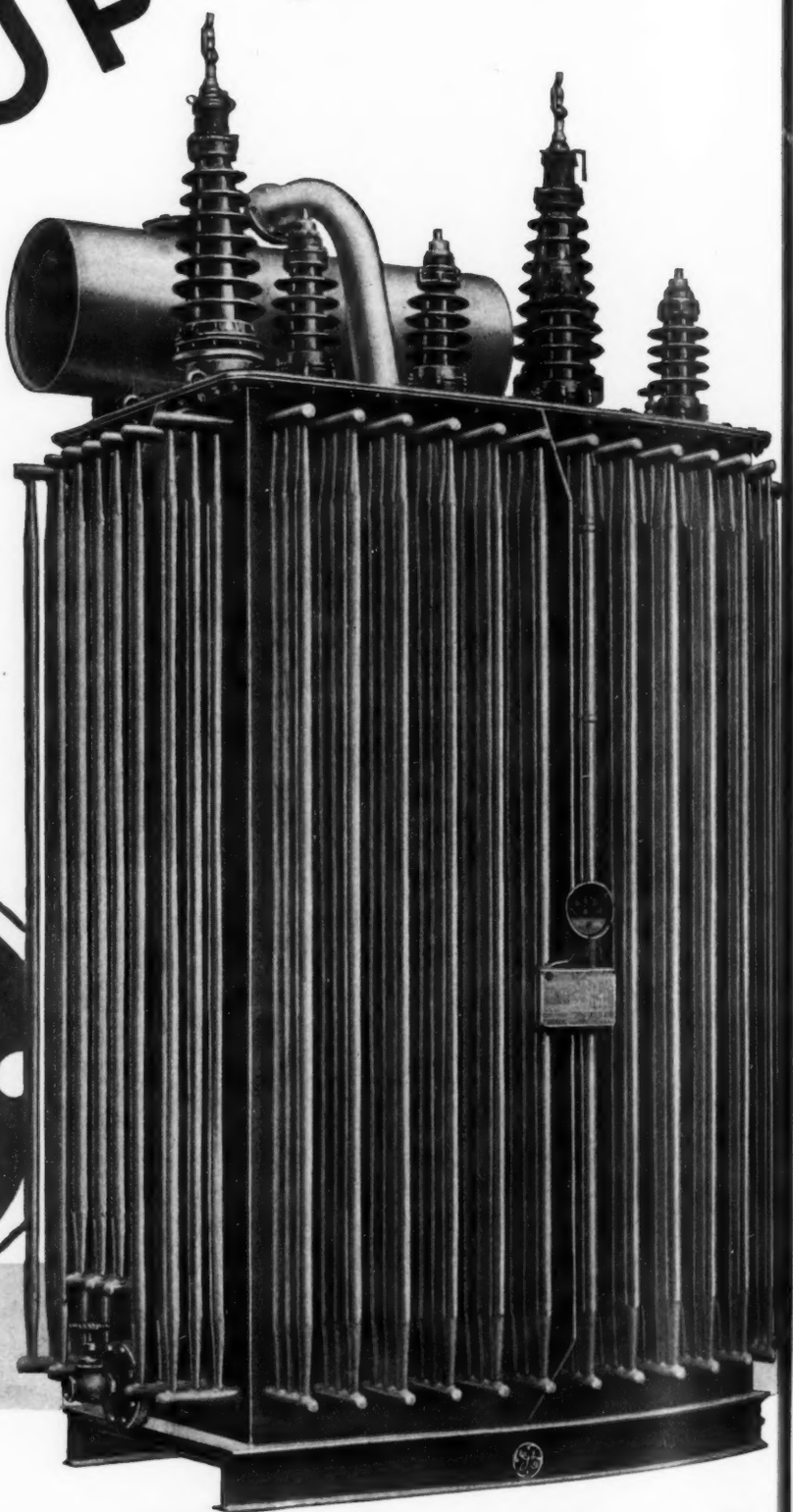
UP . . . UP . . . UP

A comparison of G-E power transformers built to-day with those built only a few years ago indicates two important benefits to the operator:

1. During the last 14 years, increased operating economies have been made possible through lower losses, decreased maintenance, and greater dependability.

2. During the last 5 years, improved service has been obtainable through higher factors of safety and much greater impulse strength.



GENERAL

ELECTRICAL WORLD

Established 1874—McGraw-Hill Publishing Company, Inc.

for the Week Ending

May 19, 1934

L. W. W. MORROW, *Editor*

Why Not Modernize With Modern Equipment?

What reason other than assumed cost economy can be brought forward in defense of the practice of "modernizing" electrical installations with old equipment? Several cases have lately come to hand where the users of electric service in industry have resurrected parts of switching equipment more than twenty years old, ordered other missing parts from manufacturers' obsolete drawings and pattern records and pointed with pride to the assembled result. Second-hand markets have been fine-combed for hybrid missing links in the equipment set-up. In a word, a kind of engineering chess has been played on some systems in the transfer of apparatus in whole or in part from one location to another. Pressure to cut costs to the bone is behind these methods, but it is questionable economy in the long run to rummage so far into the past that service foundations are exposed to the hazard of being undermined.

It ought not to be necessary to emphasize the risk the purchaser takes when he gambles on the sustained quality and efficiency of obsolete equipment as a means of saving first cost. Maintenance can be deferred for an uncertain time in many places on industrial and utility systems, but no one can tell just how long old equipment will operate satisfactorily even if well maintained. In the long run, anything that hits the competent manufacturer is bound to react unfavorably on the industries which he serves. Costs have a way of leaping skyward when makeshift methods fail, and the end is customer dissatisfaction and executive repentance. The engineer should do all in his power to clarify these matters when cost-cutting policies threaten to force him to undertake unsound practices in making provision for new service conditions.

Tomorrow's Circuit Breaker

Many men have imagined the transference of power circuit interruptions from a problem to be solved in terms of ponderable mechanics to one of electronic mechanics. Such a change in terms of the problem would instantly move the range of interruption speed from statements in units of cycles to statements in fractions of a cycle.

This conception is perfectly obvious, but, like many other things that are plain in the abstract, they lack a certain cogency of truth. The feeling is perfectly stated in the sentence, "I know it, but I have never seen it." Things known but never seen lack the final touch of reality. So it has been with the very reasonable possibility of electronic current interruption. But it is not so any longer for those engineers who witnessed the recent demonstration, described in this issue, of a grid-controlled mercury-arc rectifier in the plant of the Allis-Chalmers Manufacturing Company. These engineers saw a circuit interruption of energy of about 250 kva. occur so fast as not to fuse a wire hardly larger than a human hair.

Of course a mercury-arc rectifier is not functionally a circuit breaker. But if the thing can be done in a rectifier certainly some way will be found to do it in a functional device. Anyway, from expressions overheard during the demonstration the power system engineers who were present will not be backward about telling circuit breaker manufacturers what they saw and asking when such performance will be available for switching.

Metering Advances a Pace

As a measuring device the house type watt-hour meter has received so much engineering attention that it is in a high state of development. From the wiring or installation standpoint, unfortunately, it has not until recently received comparable consideration. In fact, there has been very little change in this respect since the early days of the induction meter. Since, the wiring has been altered to fit the meter, but this has very seldom resulted in an economical or satisfactory wiring arrangement, because the problem was not accepted as constituting a service installation unit.

This issue of the ELECTRICAL WORLD carries an announcement of a meter mounting standardization program worked out co-operatively by the electric light and power and meter manufacturing groups. This is gratifying, and particularly interesting as a demonstration of what can be accomplished when all the interested divisions co-operate for the good of the industry as a whole.

Adoption of this new standard by all manufacturers will immediately make feasible the setting up of meter practice to bring about lower installation costs. The complete interchangeability of mountings will later lower operating cost and eventually should result in a lower cost of the meter itself. Also, an additional economical weapon has been provided which should prove very effective in discouraging diversion of energy.

Agreement on this unified practice brings to completion one phase of a complete and progressive installation program which the ELECTRICAL WORLD has been advocating for a long time. With a proper meter mounting standard assured, the electric light and power group can and should now give similar attention to house wiring and the other component parts of service entrance equipment. With the same co-operation between the utilities, the manufacturers, insurance and other interested groups much can and will be accomplished.

Home Modernization—An Opportunity

A recovery housing bill is being backed by the Administration in an attempt to modernize existing homes, stimulate new home construction and remove obsolete structures. Estimates put the volume of business available at $1,500,000,000. Under government auspices, credit may be mobilized to enable a home owner to combine in one purchase operation all he can afford to pay for out of income in a period of one to five years. A government agency would insure the credit risk.

This proposal spells opportunity to the electrical industry, for home modernization means home electrification. The insurance of credit should enable sales to be made in volume. The use of a single buying operation should enable a group of appliances or an entire rewiring job to be sold at one time. Surely the idea of electrical comforts and conveniences belongs in any plan to aid home modernization. The National Emergency Council, sponsor of the housing modernization program, can count upon the co-operation of the electrical industry.

Code to Coal to Water

A 40 to 60 per cent increase in the price of coal as a result of NRA makes a marked change in the economics of power production. It brings hydro power back into the picture and offsets the gain of ten years intensive research in burning coal. It is equivalent to decreasing the coal market very materially so far as the utility industry is concerned.

Before the present shift occurred a $70 per kilowatt steam station compared quite favorably with a $125 per kilowatt hydro station, because the operating cost resulting from burning coal was offset by the lower fixed charges and by other charges incidental to having fuel-burning stations near the load. Increase the price of coal at the mine 50 to 70 per cent and increase the labor, freight and other handling costs and it is very evident that the cost of energy produced from fuel is increased from 30 to 40 per cent.

What will be the effect? First it will bring into use all possible hydro capacity in the existing installations of the industry. Second, it will bring back plans for building more hydro stations when there is a necessity for additional capacity. Water-power sites will be in demand. Third, there will be a very great increase in operating expenses for those utilities that have fuel-burning plants only sufficient to make some of the tax increases relatively insignificant. A further effect will be to stimulate interconnection and transmission involving regional hydro possibilities.

Without going into the facts as to the justification for increased coal prices, the conclusion is inescapable that this constitutes the most significant economic factor imposed upon the power industry by the NRA.

Retirement vs. Depreciation Accounting

By E. P. COLEMAN
Investment Analyst National Life Insurance Company

Retirement Accounting Simplest, Most Practical and Fairest to the Owner and Consumer—Depreciation Accounting Academic, Expensive and Impractical for the Utilities

THIS subject has been discussed from so many angles and at such length that the fundamental facts have become obscured by a smoke screen of partisan argument. Unfortunately the public representatives are too often guided in their attitude by a desire to justify rates that are in effect camouflaged confiscation and, on the other hand, the attitude of many public utilities reflects a desire to increase unduly the rate of return. The writer, having gained some knowledge of the subject during years of practical experience, is now in a position to discuss the question impartially and without prejudice, and this expression of opinion is made in a sincere effort to assist in clarifying the situation. It should be noted that, while the broad principles outlined apply with equal force to every type of public utility, this discussion particularly refers to operating electric light and power properties.

It is generally admitted:

(a) That physical property commences to deteriorate, or wear out, from the moment that it is put in use.

(b) That the investor in a regulated industry is entitled to recompense for the loss in value of property worn out in service.

These admitted facts would appear to constitute a strong argument in favor of "depreciation accounting," but we must also take into consideration these additional and very pertinent facts:

(c) That the term depreciation as generally used not only covers physical depreciation, or wear and tear, but also functional depreciation, or enforced retirement because of obsolescence, inadequacy, or the orders of public authority.

(d) That the far greater proportion of retirements and replacements result from functional causes or from accidental destruction, are difficult to reconcile in their relation to physical depreciation and can never be estimated accurately in advance.

(e) That physical depreciation and maintenance are so closely related that they can only be segregated at a cost for supervision that is entirely out of proportion to the result. Properly maintained, that portion of a utility property that is most susceptible to physical depreciation resembles in time the boy's knife that had new blades and a new handle, but was still the same knife. No method of accounting for depreciation can ever be complete unless the effects of maintenance are considered.

A confusion of ideas

It has always appeared to the writer that much of the controversy over this question indicates a confusion of ideas. As a matter of fact, the owner is not guaranteed by the law or by justice against loss of physical property, he is merely protected against acts of public authority which would prevent him from earning a fair return on his investment and from preserving his investment intact. At the same time he must maintain the continuity and quality of his service to the public, which requires frequent replacement of physical property, and that is an expense for which he is entitled to compensation. The California judge who, in the case of San Diego Water Company vs. San Diego, stated in effect that replacement is an operating expense was nearer right than he has been given credit for.

Let us again state the fact that it is the investment that is entitled to be preserved intact and not the individual items of physical property. A public utility does not die piecemeal at a uniform and calculable rate, but is being continually renewed and expanded, and is, in fact, a living business enterprise that must at all times be ready to render a vital service promptly and efficiently and is constantly changing in physical form. It is this business enterprise and the amounts invested in it that are entitled to be protected from depletion, not the ephemeral units of physical property. If this conception of a public utility is clearly visualized and accepted much of the fog surrounding the question of depreciation will be dissipated.

A new wave of discussion on depreciation calls for clarification of thought. Out of a practical experience Mr. Coleman analyzes the problem as it affects electric light and power properties and shows the final measure to be the cost to the consumer.

Owners of a public utility make, or should make, such investment on the assumption that the enterprise will continue to exist and prosper throughout the term of their holdings. If it should by mischance cease to function as a public utility, as has sometimes been the case, their investment will become worthless, for neither the business nor the physical property can be removed to other fields of action or diverted to other purposes. If such mischance should occur the physical property will at once become practically without value and no method of accounting can possibly provide against such an emergency. The consuming public is under no legal or moral obligation to protect the owners from the ordinary hazards of business, which do not, however, include political

assassination, and if the owners wish such protection they must themselves make suitable provision from their allowable return.

Provisions for losses necessary

The question now under discussion is, however, that of how the losses due to worn-out, deteriorated, retired or replaced property, usually and erroneously referred to as "depreciation," are to be provided for. This is a question of practice and not of theory. The problem is, how to accomplish a given purpose in the most simple and direct manner, with strict justice to the owner and to the consumer and at the least expense to either or both. The two methods in common practice over which the controversy rages are the "depreciation" method and the "retirement" method of accounting, and an excellent definition of these methods, which clearly indicates their essential difference, has recently been brought to the attention of the writer:

"A charge for depreciation is a recognition of a loss already suffered in property value. A charge for retirement expense, on the other hand, purports to be only a prudent provision in advance for an as yet unrealized and incalculable future loss."

The argument for depreciation accounting is, in brief, that physical property is admittedly consumed in service and that any method of accounting that is not primarily based on that fact is illogical and an evasion of the fact. If that fact did not happen to be only one of many pertinent facts, and if the major portion of physical property retirements resulted from the completion of natural service life, and if depreciation accounting only recognized losses due to deterioration, and if it were possible properly to segregate maintenance and its effects from depreciation without undue complication and expense, this argument would be sound, but such are not the facts. Quoting, with due regard to the context, from the pamphlet *Depreciation,* prepared by the staff of the Wisconsin commission, which is a very able and complete presentation of and argument for depreciation accounting:

> Briefly, depreciation consists of the consumption of property in service. . . These causes of property consumption are exceedingly variable, fluctuating and uneven in effect (page 4).
>
> The distinction between maintenance and depreciation is often very difficult. But it is not impossible or impracticable to make, and it is vitally essential to the proper handling of depreciation (page 6).
>
> In this connection we wish to reiterate that at best depreciation accounting is a matter of estimates. . . the amount of such reserves must be adjusted from time to time. . . (page 120). . . . since depreciation is inherently so much a matter of estimates and conjecture (page 161).

The depreciation method of accounting, possibly because of its complexity, evidently appeals strongly to economists who are able writers, but absolutely without practical operating experience. They stress the theoretical, and present tables of elaborate computations which, to the practical mind, emphasize the fact that the determination of straight-line depreciation, even aside from the necessary allowances and assumptions, is a very technical, complicated and expensive process and that the conclusions would never be accepted without question. Decisions of the higher courts are usually quoted at length in support of the depreciation theory, although in many cases a careful study of the decision in all of its implications will suggest the contrary interpretation.

Retirement accounting treats deterioration as a minor factor to be ignored until its effects compel retirement, leaning more toward the preservation of the investment as such, and combines maintenance and depreciation, both physical and functional, in one broad classification. Years of experience have demonstrated the fact that a certain proportion of the operating revenue, varying along recognized lines in different classes of properties, when set aside for maintenance and the unexpended balance carried to retirement reserve, will properly provide for the maintenance of the physical property in efficient operating condition and allow retirements and replacements beyond the ordinary to be made without distortion of the current accounts and operating record.

One outstanding advantage of the retirement method is that its accuracy can be easily and positively checked. If, during a term of years, the amount of the retirement reserve remains fairly level in percentage of property value, which will probably increase from year to year, and the property is well maintained, which can be easily determined by observation, it may be reasonably assumed that the allowance for maintenance and retirement is substantially correct. This method also allows the full advantage of deferred maintenance to be secured without distortion of the current record. To defer maintenance is an exercise of a proper function of prudent management and, contrary to popular impression, in the best interest of all concerned when wisely exercised. Repairs consist, as a rule, of a series of minor replacements that may often be deferred in time of financial stress in the knowledge that the future inevitable replacement will cost no more than it would at present.

Objections to the established practice of basing the retirement allowance on revenue are mainly academic and further illustrate the tendency to complicate a fundamentally simple question by over-argumentation. The allowance might, if desired, be based on property value, but the present practice has many practical reasons for its retention. It is also claimed that the retirement allowance may be and often is varied by the management to compensate for a change in the level of net income. This is without doubt a fact, but it is also a fact that the set-up of a retirement allowance is just as much under the control of a commission as would be that of an allowance for depreciation.

Lowest cost to the consumer

Last, but far from least, the effect on the consumer's pocketbook should be observed, for that is what he is really interested in. His desire is to receive efficient service at the lowest possible cost. The writer has tried without success to obtain comparative figures of depreciation and retirement as applied to the same property, but all of the evidence available indicates that the depreciation allowance would be at least double the correct ratio of retirement. On this basis the substitution of depreciation accounting for retirement accounting would, in order to secure the same return, impose upon the consumers an increase in cost of about one-half of 1 per cent on the rate base, in exchange for the doubtful advantage of a reduction in the base.

From all of the above it would appear that retirement accounting accomplishes the given purpose "in the most simple and direct manner, with strict justice to the owner and to the consumer and at the least expense to either or both" far better than depreciation accounting.

Motors and Lines Share Home "Weather" Load Problem

How a Foresighted Power Company Plans to Meet the Special Difficulties Imposed by This Type of Load

By F. E. SANFORD . . . W. R. WEISE
Distribution Engineer — Assistant Engineer
Union Gas & Electric Company, Cincinnati

1. A successful program for air-conditioning equipment installations must be based on an economic balance of investment and cost to operate. The customer's cost to operate must include carrying charges for the investment by the utility company. A rebuilding of existing electric distribution systems does not reconcile with minimum net cost for energy. A separate transformer, service and meter for loads that are used only a few months each year is entirely unjustified.

2. Design of residential air-cooling compressor equipment may or may not need to be along somewhat different lines than larger commercial equipment, to meet the service conditions. It is known, however, that some types of equipment as now designed are satisfactory. These designs may or may not cost more, but even if they do cost more there is no reason to sell and install equipment which causes the user annoyance and trouble.

3. A reduction of transformer impedance offers, in general, only a slight improvement in distribution design for this service and is not the solution to this problem.

4. We cannot agree with Mr. Hellmund (ELECTRICAL WORLD, March 17, 1934) that residential air cooling should mean a complete revision of the distribution circuits. Rather, a spirit of co-operation should prevail to the end that minimum *over-all* cost results to the user, who is the customer of both the manufacturer and the utility.

COMPARED to the feeder transformer and service capacities in high-load density commercial areas, the widespread overhead equipment in residential areas has quite low capacity. Where residential air-conditioning equipment is to be installed it may be served in one or two ways:

1. From the existing secondary mains serving residential lighting and small appliances, or

2. From special secondaries, one-phase or three-phase, installed for the power equipment of air conditioning.

Service from the existing secondaries is logically the most economical. A separate service would mean greatly increased investment for the utility, in transformer installations, wire, meters, and for the customer, in wiring. For installations of less than 10 hp. three-phase services cannot be justified where separate transformer banks are necessary. It should be remembered that this equipment will be used only about one-fourth to one-third of the year and that additional investment cannot be reconciled with a minimum net cost for energy.

If served from a special secondary, one installation of compressor equipment would require from $100 to $150 additional investment, if one-phase. Further equipment after the first service would require $30 to $50 additional investment. Three-phase service would require $200 to $250 new investment, *plus* the cost of reaching the location with additional primary lines. The advantages of diversity and seasonal factor would be lost with separate services and would increase the transformer capacities necessary.

Refrigerators, with their low demand, have very good load factor. Air-conditioning equipment, especially the compressor used for cooling, will have a highly seasonal load factor and will represent a considerable increase in demand in the residence. The average consumption for a one- or two-room cooling unit will probably be of the order of 1,000 kw.-hr. per year, which at a 3-cent rate will represent about $30 per year to the utility. While

Prospects of air-conditioning loads are attractive, to be sure, but the realities of rendering the service will bring some headaches to operating men unless there is wise planning. Distribution engineers are worried about compressor-caused light flicker. After considerable investigation, here is how Cincinnati proposes to meet the problem.

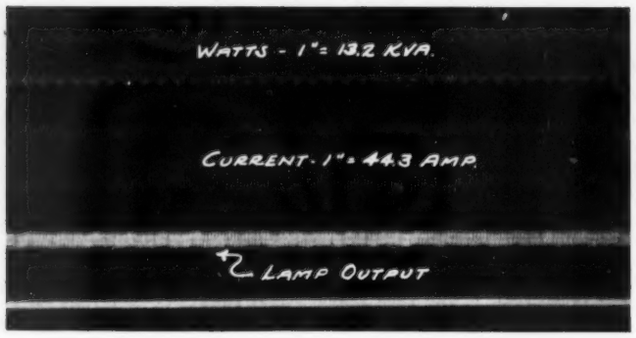


Fig. 1—Two cylinders and low power factor make flicker

Repulsion-induction type motor driving compressor: 2-hp., 220-volt, single-phase, two-cylinder, twelve compression strokes per second. Current variation 95 to 117 per cent of rated current. Power factor varies from 52 to 79 per cent. Light flicker very annoying.

Supply was from a 10-kva. transformer one span from the service. Secondary main No. 2 wire and the service was No. 6 wire. Total impedance 0.296 ohm (at 32 deg.).

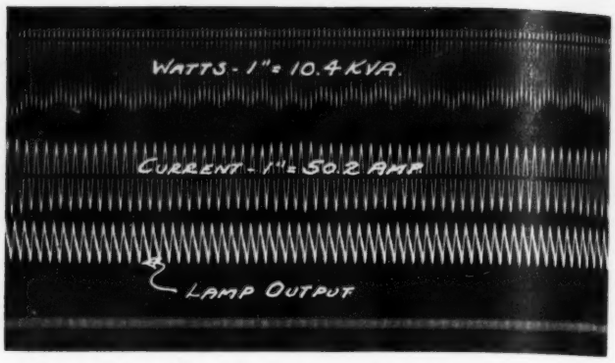


Fig. 2—No flicker from capacitor motor and three-cylinder compressor

Capacitor type motor driving compressor: 3-hp., 220-volt single-phase, three-cylinder, twenty compression strokes per second. Current variation, 91 to 97 per cent of rated current. Power factor varies from 84 to 89 per cent. No flicker apparent.

Service (as in Fig. 1) was from 10-kva. transformer one span from the service, but the secondary mains were No. 6 wire. Total impedance 0.354 ohm (at 27.5 deg.)

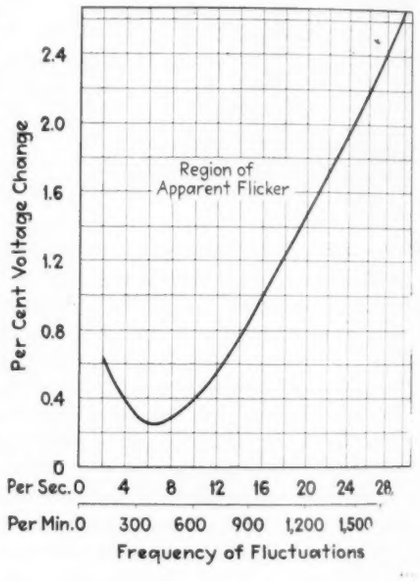


Fig. 3—Voltage change that will cause annoying lamp flicker depends on frequency of fluctuation

Flicker is not noticeable for conditions represented by the area under the curve.

this is about twice the consumption and revenue expected from refrigerators, the load characteristics are such that it is plain that addition of this load is not entirely "cream."

Most of the air-cooling equipment now on the market has as its main unit a motor-driven reciprocating type compressor of two or three cylinders. Crankshaft speeds of 360 r.p.m. and higher are common. This gives as low as twelve compression strokes per second to fifteen or twenty or higher, depending on the number of cylinders, motor speed and drive ratio. Repulsion-induction and capacitor motors are used. Starting current regulations are fairly well standardized and should not be expected to present any new problems in this type of service.

However, due to the rapidly fluctuating nature of the compressor load there may result fluctuation in current drawn by the motor during the running period. The accompanying oscillograms, taken on two installations, show the type of variation to be expected. During the running period the installation of Fig. 1 gave a decided voltage fluctuation which was very annoying because of the light flicker caused. It is evident that very little improvement could be made in the service except to separate the lighting service from the service to the compressor.

Fig. 2 shows an oscillograph record from a capacitor type motor driving a 3-hp., three-cylinder compressor with twenty compression strokes per second. No flicker was apparent in this case.

The curve in Fig. 3 was obtained from observation and tests by the writers and the values check fairly closely with a similar curve published in *Power,* January 6, 1932. It will be noticed that the most critical frequency is about six fluctuations per second when a 0.25 per cent voltage variation gives an apparent flicker. Increasing the frequency to ten per second increases the allowable voltage change to 0.4 per cent, and if further increased to twenty per second will allow a 1.5 per cent voltage change.

Voltage pulsations are the result of the change in magnitude of the current and the power factor. A comparatively small change in magnitude of the voltage drop can cause serious voltage pulsation if the power factor varies as much as 30 per cent, which is common when repulsion induction motors are used.

If the impedance angle of the secondary system, including transformer, secondary mains and service, approaches the angular displacement of the current at maximum magnitude the change in voltage will be maximum. When the

Effect of Current and Power Factor Change on Voltage Regulation

Secondary System		Voltage Variation at Service Pole				Voltage Variation at Entrance Switch, Service = 1 sp. No. 6 wire				
		Transf.	1 sp.	2 sp.	3 sp.	4 sp.	Transf.	1 sp.	2 sp.	3 sp.	4 sp.
5 Kva. No. 6 sec. mains	R.I.	0.58	0.88	1.18	1.48	....	0.78	1.08	1.38	1.68	....
	C.	0.13	0.20	0.27	0.34	....	0.18	0.25	0.32	0.39	....
10 Kva. No. 2 sec. mains	R.I.	0.25	0.36	0.46	0.57	0.67	0.45	0.56	0.66	0.77	0.87
	C.	0.05	0.07	0.09	0.11	0.13	0.10	0.12	0.14	0.16	0.18
25 Kva. No. 2 sec. mains	R.I.	0.06	0.17	0.27	0.38	0.48	0.26	0.37	0.47	0.58	0.68
	C.	0.005	0.026	0.047	0.068	0.089	0.055	0.076	0.097	0.118	0.139
25 Kva. No. 00 sec. mains	R.I.	0.06	0.10	0.14	0.18	0.22	0.26	0.30	0.34	0.38	0.42
	C.	0.005	0.01	0.015	0.02	0.025	0.055	0.06	0.065	0.07	0.075

R.I. = Repulsion-induction motor load. Current variation 13.3 amp. $/\overline{59°}$ to 16.4 amp. $/\overline{37°}$

C = Capacitor motor load. Current variation 14 amp. $/\overline{33°}$ to 15 amp. $/\overline{27°}$

Proposed Regulation for Air-Conditioning Installations

With the service limitations as outlined in the paper, a designed limitation on air-conditioning compressors to be installed in overhead service areas has been proposed for the Union Gas & Electric Company's territory. It is realized that some revision of this proposed regulation may be desirable and necessary, but, on the other hand, it is felt that some such regulation or the co-ordination of equipment which should result from it is absolutely necessary if the load is to be sold, served and used in residential areas.

Starting currents must be in accordance with the present regulations for motor equipment. Installations of less than ½ hp. may be rated at 110 volts, single phase. Installations of ½ hp. or more and less than 10 hp. may be rated at 220 volts, single phase. For 10 hp. and larger service will ordinarily be at 220 volts, three phase. In addition, motor-driven compressors served from the company's 120/240-volt, three-wire lines must have characteristics during the running period such that:

The voltage variation caused by the compressor shall not exceed the accepted value for its compression frequency (must not be above the limit of apparent flicker, Fig. 3), when its current is supplied through an impedance of 0.25 ohm at 43 deg. (73 per cent lagging).

Details of design, such as speed, flywheel inertia, power factor, etc., can be varied for different equipment, to meet this requirement. A mathematical analysis to determine resultant variations, based on the proposed constants of a given design of machine, might be useful to the manufacturers' engineers in this connection. A specific limitation to meet this regulation is:

Compression frequency must be less than 200 or more than 700 per minute. Instantaneous current variations and power factor variations must each be less than 10 per cent, during the running period, with a minimum instantaneous power factor of 70 per cent.

current is maximum the voltage drop is subtracted directly from the supply voltage, and when minimum current occurs the decreased voltage drop swings out of phase and the effective decrease in voltage becomes greater as the angle increases.

The repulsion motor as tested gave a power factor variation of from 52 to 79 per cent as compared to an 84 to 89 per cent power factor variation in the test on the capacitor motor. This decrease in phase shift of the voltage drop was quite effective in the elimination of lamp flicker during the test of Fig. 2.

Elimination of lamp flicker by means of increasing the frequency of the impulses without limiting the magnitude of the variation is logical only if we assume that an individual service will be supplied for each installation. When two or more units are in operation simultaneously on a common secondary system beat frequencies occur which amplify the magnitude of the voltage change and decrease the frequency. A unit with a frequency of 30 per second and one with 20 per second operating simultaneously will produce a voltage pulsation of ten impulses per second. Although each operating by itself may cause no trouble, the combined effects will cause very objectionable flicker. The possibility of two units operating simultaneously must be considered and necessitates rules limiting current and power factor change, which limits the magnitude of the voltage change.

The data obtained in the tests were applied to various secondary system to compare the voltage pulsation. The results are shown in the accompanying table.

A 3-hp. capacitor motor served by a 5-kva. transformer through three spans of No. 6 secondary mains and a No. 6 service will create the same voltage variation under running conditions as a 2-hp. repulsion-induction motor served by a 25-kva. transformer through three spans of No. 00 secondary mains and a No. 6 service.

In general, the voltage variation caused by the capacitor type motor would be less than one-fourth as severe as that caused by the repulsion-induction type motor as tested. This table also shows the inadequacy of No. 6 service lines for compressors driven by ordinary induction motors. For the 25-kva. No. 00 secondary system about one-half the total drop would be in the No. 6 service, to say nothing of the house wiring drop, which must be considered if portable units are sold.

Air-conditioning installations of moderate size, or about 3 hp., can be accommodated on existing secondary lines if limitations on the frequency of pulsation, fluctuations in current and variations in power factor are adopted. Some secondary layout must be taken as average and the rules developed about this system. If a system composed of a 15-kva. transformer, three or four spans of No. 2 secondary main and a No. 6 service is taken the resultant impedance is 0.25 ohm at 73 per cent power factor. The minimum power factor should then be 70 per cent and current fluctuations should be limited to 10 per cent because a 1-amp. change represents 0.25-volt variation.

Water Rheostat Permits Irrigation Flow

By H. J. LAWSON
General Superintendent and Chief Engineer
Salt River Valley Water Users Association, Phoenix, Ariz.

Due to the complete shutdown of the copper mining industry in Arizona during the past year or more the power load of the Salt River Valley Water Users Association suffered a considerable drop, this load, in normal times, amounting to more than 20,000 kw. This is primarily an irrigation project and water for irrigation purposes must be released from the four reservoirs on the Salt River at or through power plants located at each dam. The Horse Mesa plant has a head of 272 ft. and has the highest head of any plant and consequently less water is passed with a given load than at the lower head plants. It became necessary early in 1933 to pass more water from the Horse Mesa reservoir than the power load required, and as the water in the reservoir was below spillway level some means to pass the additional water had to be found. The following expedient was adopted:

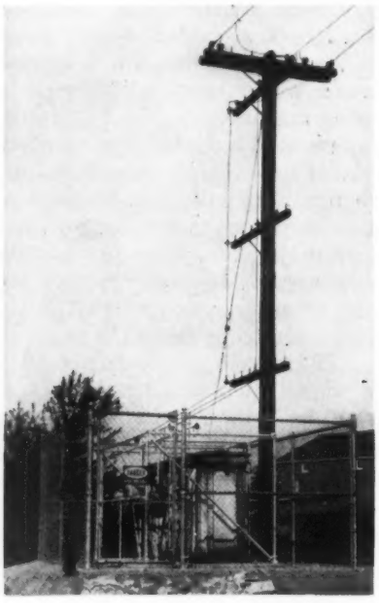
A water rheostat was built consisting of 4-in. iron pipes about 6 ft. long, hung on a triangular wooden frame with pillar type insulators at the corners of the frame, the pipes being pendent from these insulators. The rheostat was hung over the tailrace and was supported by cable with rope block and tackle into the power house so that raising or lowering the rheostat could be accomplished with rise or fall of water level in the tailrace. During 1933, from March to October, one 11,000-kva., 11,000-volt generator was run on the rheostat, thus operating the water wheel at practically full gate opening continuously.

The electrodes of the rheostat are spaced on a 12-ft. equilateral triangle. For the rheostat to absorb 600 amp., approximately 8,000 volts was carried on the 11,000-volt generator. The water of the river carries approximately 570 parts per million of solids, mostly common salt. The rheostat operated perfectly with the exception of once, when flashover at one electrode occurred due to salt deposits on the insulator. This was corrected by keeping the rheostat slightly higher in the water, thus eliminating any splashing of water on the insulators. A slight flashing occurred more or less continuously just under the water surface, but without any noticeable effect. There was practically no visible corrosion of the iron pipes after eight months constant use. Two generators have at times been connected to the rheostat, which handled the resulting load of about 18,000 kw. without trouble. With the higher load the voltage on the rheostat was about 9,000 volts.

Unified Industrial Substation Simplifies Field Work

How a New England Power Company Has Standardized Its 2,300-4,000-Volt Transformer Stations to Advantage

By R. J. RAINNIE
Blackstone Valley Gas & Electric Company, Woonsocket, R. I.



Completed assembly of substation with overhead primary and underground secondary feed to mill

A CONVENIENT and permanent assembly which we call an industrial substation fixture has been developed by the Blackstone Valley company to facilitate the installation of transformer banks from 150-kva. to 450-kva. rating. The company has a large industrial load and supplies power to many smaller mills and shops from such banks from 2,300- and 4,000-volt primary feeders.

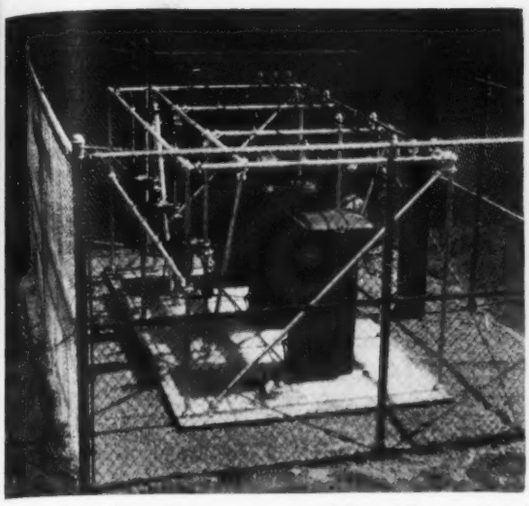
Formerly when making such installations it was the practice to build a timber and plank platform large enough to accommodate the transformers and then to build a suitable wooden framework to support the necessary feed wires and buses, surrounding the whole with a wire screen or wooden fence. Primary protection was located at the nearest pole, requiring the services of a climber in case of trouble or shut-downs.

As these assemblies lacked flexibility and required considerable maintenance after a few years, it was felt that the added cost of a permanent unit would be more than offset by reduced maintenance charges, besides giving a much better-appearing installation. The first unit of the new type was built in 1928 and since then twelve more have been constructed, eight to serve new customers and four to replace existing installations.

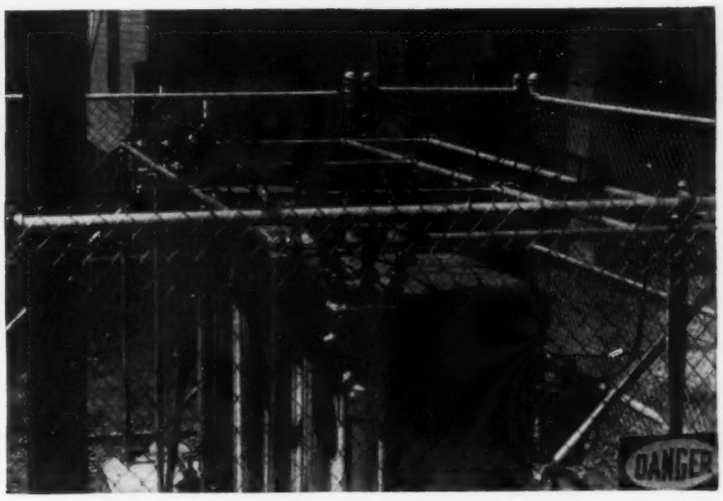
The assembly as developed consists essentially of a concrete mat 7 ft. wide, 13 ft. long and 1 ft. thick, on which is mounted a framework built up of 1¼-in. galvanized iron pipe joined together by Delta-Star "Uniclamp" pipe fittings. For overhead supply, which is mostly used, a 35 ft. creosoted pine pole is set beside the center of the mat on the secondary side, to carry the primary and secondary as shown in the diagram. D.&W. oil fuse cutouts are carried on the framework on the primary side at a convenient height for operation. Lightning arresters are installed at the primary dead-end on the pole. The whole is surrounded by a 7-ft. galvanized chain-link fence with a 4-ft. gate at a corner giving access to the primary cutouts.

When constructing a new fixture the location is first staked out with due regard to accessibility, facilities for placing transformers and distance from buildings as required by insurance rulings. The pole is usually set first to preclude the possibility of caving under the mat. The concrete mat is then placed on a cinder or gravel fill, a layer of "steelcrete" being inserted at top and bottom.

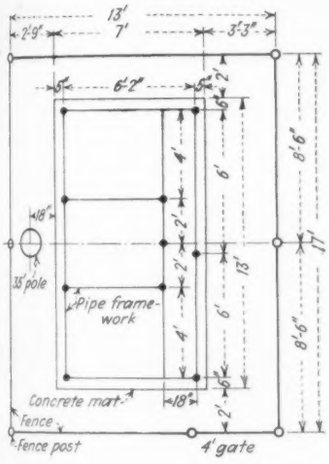
When the concrete has set erection of the pipe framework is started. A schedule of cutting lengths has been



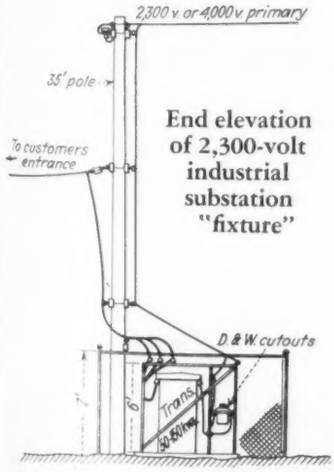
Looking down on assembly with overhead primary and secondary service



450-kva. unit with end potheads for double secondary feeds to industrial customer



Plan of unified layout for 2,300-volt service

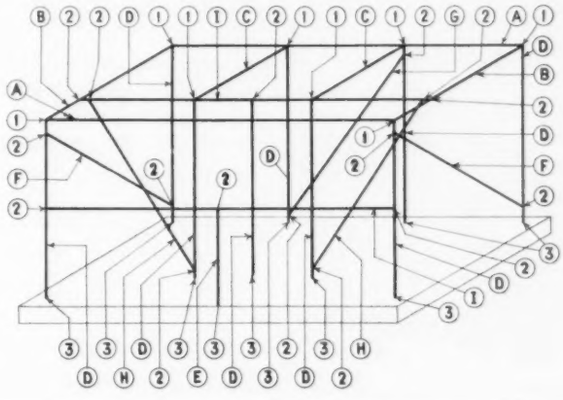


End elevation of 2,300-volt industrial substation "fixture"

worked up and all that is necessary for the foreman in charge is to have the pipe cut to size and obtain from stock the "Uniclamp" fittings, floor flanges and anchor bolts, which are also listed in the schedule. A simple one-line erection diagram is then followed. The D.&W. cutouts are mounted on small angles drilled to accommodate both the 100-amp. and 200-amp. sizes, so that in the event of a transformer size being increased, there is no difficulty in changing the cutout. The framework erected and the transformers placed, the fence is put up and the necessary wiring done. Line wires are then run in and unit is ready to be placed in service. Primaries may be run in from any direction and various arrangements for secondary pull-off may be made, as shown in the accompanying illustrations.

Primary or secondary lines, or both, may be run underground without any changes other than bringing up the necessary ducts. Transformers may readily be removed or changed, three 150 kva. units being the maximum size, since customers requiring more than this rating are supplied through a high-tension substation.

Layout of pipe framing and fitting locations for standard 2,300-volt unit



1¼-In. Galvanized Pipe

Item No.	Length Ft.	Length In.	Required	Item No.	Length Ft.	Length In.	Required
A	12	2	2	F	7	10	2
B	6	0	2	G	6	5	1
C	4	3½	2	H	6	6	2
D	6	0	9	I	11	10	2
E	3	0	1				

Table of Pipe Fittings Required in Installations

Item No.	Galvanized Pipe Fittings Description of Material	Fitting No.	Parts Required: Type "SH" (1¼-In.) Cat. No. 363,003	Type "SQ" (1¼-In.) Cat. No. 363,021	Type "SF" (1¼-In.) Cat. No. 363,032	Type "SB" (1¼-In.) Cat. No. 363,050	Expansion Anchors	Sherardized Bolts
1	Elbow—one side outlet	3	40	16	0	40	0	0
2	Elbow	16	64	0	0	48	0	0
3	Floor flange	60	0	0	20	20	0	0
	½-in expansion anchors		0	0	0	0	20	0
	½ x 2-in. sherardized bolts		0	0	0	0	0	20
	Totals		104	16	20	108	20	20

Current Transformer Installations Speeded

Solder and blow torch may never be entirely eliminated from meter installation work, but this idea pushes them farther along toward the discard.

By E. E. KLINE
Superintendent Electric Meters, Union Gas & Electric Company, Cincinnati, Ohio

Difficulty in the installation and removal of low-voltage instrument current transformers by the use of the conventional soldering lug involves considerable time, trouble and expense. Since the size of transformer for any particular job is determined by the actual demand, while the service wiring is designed to conform to the provisions of the National Electrical Code or, in some cases, may be designed for future requirements, it is often found that the lugs which go with the transformers selected are too small for the installed cable. Also, it is often necessary to change transformers in service in accordance with changes in customer load. Here, again, additional difficulties present themselves. Practically every make and type of transformer has slightly different terminal arrangements, with still other variations between different ratios. Many of these transformers are equipped with different types of soldering lugs. As a result it is generally necessary to solder new lugs every time transformers are changed.

The specific requirements for a connector which would obviate these difficulties are that it should fit all, or at least a large majority, of the types and makes of transformers within a given range of ratios, and also all of the sizes of cables which might normally be encountered in service with these transformers. Furthermore, the connector should be relatively simple so that the transformers could be installed or changed with a minimum of time and trouble. And the connector should be small so that it could be easily installed.

These specifications, therefore, led to the design of the connector shown in the illustrations. How well the connector meets these very stringent requirements may be realized by the fact that (1) in the case of the Union Gas & Electric Company, since the majority of current transformers used are of the smaller ratios, the connector will fit approximately 90 per cent of all of the current transformers used by the company, excluding those which are installed in buses, in which case no connector is required, and (2) by the fact that the connector will take the following sizes of cables:

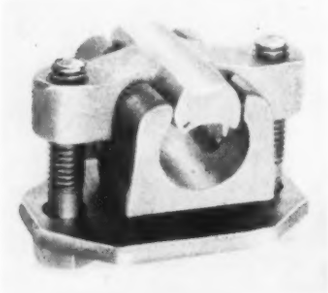
One cable	All sizes between No. 6 and 500,000 circ.mil.
Two cables	All sizes between No. 6 and 400 inclusive
Three cables ...	All sizes between No. 6 and 200 inclusive

By the use of longer bolts two connectors can be mounted back to back to take any two of the above combinations. A connector can, of course, be made to take a wider bus and larger cables.

In contrast with soldering lugs, which involve considerable time and trouble to remove from the cable, these connectors can readily be brought in with the transformer when it is removed from service. Thus a salvage value of 100 per cent is possible. When installing instrument current transformers in metal inclosures it is necessary to bend the cable out of the inclosure in order to solder the lugs to the cable. This difficulty is eliminated by the use of these solderless connectors.

Comparative tests with other types of solderless connectors and with soldering lugs indicate that this connector has approximately the same temperature rise for equivalent loads.

While a connector of this type costs more than the conventional soldering lug, it is felt that the savings involved in the installation of instrument current transformers using these connectors and the elimination of the hazards and disadvantages of soldered connections more than compensate for the increased cost.



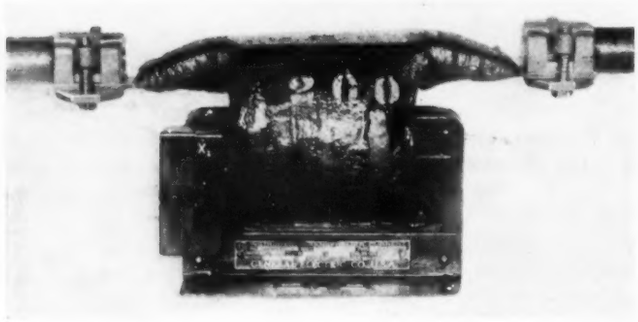
Current transformer connector is versatile

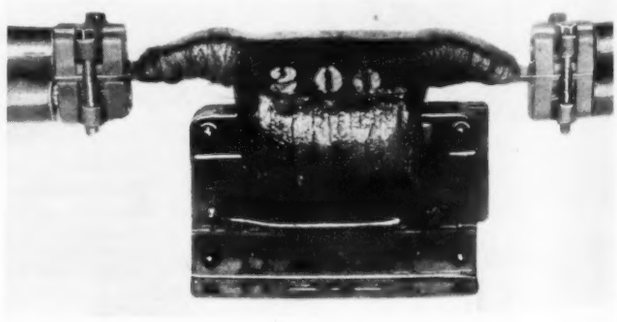
At left is the single connector. At left below it is applied to single cable. At right below two connectors, with bottom plates removed, are put together with longer bolts to hold two conductors.

Generating Capacity Cuts Reduce Obsolete Equipment

Electric light and power companies have been taking advantage of the opportunity to keep their construction crews at work by dismantling obsolete equipment. They are meeting the rising tide of the demand for energy with their houses in order.

This process of house cleaning has been more widespread than is generally realized. Of 137 major systems listed in the Supplement of May 5 almost a third—43, to be exact—reported less capacity at the end of 1933





than in 1932. The reductions aggregated 338,579 kw., of which 279,526 was fuel driven and 59,053 kw. hydro. The net reductions of the entire 137 were, of course, less, for quite a number of companies made additions during the year. Numerous small plants or units were discarded. In contrast with this twelve companies reported a decrease exceeding 5,000 kw.

This means that as the loads build up again—and they are coming rapidly—the obsolete equipment must be replaced by more efficient machinery. Present indications are that the industrial consumption during April was close to that of 1931 and perhaps within 10 per cent of that of 1930. As recently as January the deficiency, compared with the latter year, was 21 per cent.

Domestic service also is increasing. Although residential users economized during 1933, this class of service has already surpassed that of 1932 and is well above the level of all earlier years.

Informal opinions on present conditions and problems confronting the industry are helpful. We welcome to this forum the type of discussion presented by Mr. Comerford and hope others will discuss industry questions in a similar constructive vein.

Frank D. Comerford asks*——

President
New England Power Association

A square deal for electric utilities under the New Deal

"During a very trying year the New England Power Association did its best to maintain employment in the face of an almost complete cessation of new construction. At the request of municipalities we prepaid taxes in order that municipal payrolls might be met. During and after the bank holiday we co-operated with and facilitated the reopening of banking institutions. In many ways we have helped our customers to meet problems of the depression. From those engaged in the relief of human suffering we have received generous acknowledgment of our helpfulness in their various campaigns. Civic bodies which assumed a leadership in the work of national recovery found us ready and willing to co-operate. We subscribed to the President's re-employment agreement as to wages and hours, necessitating increased annual payroll costs of more than $500,000, and have actively assisted in formulating a permanent code for the electric light and power industry.

"For these services we neither asked nor anticipated reward. But we believe that we deserve something more than the persistent attack which has been leveled at the industry. For the wrongful acts of a few men an entire industry is being assailed. There are individuals who do not understand the complex nature of our business but who seem willing to join in any attack on a public utility. Your officers and directors recognize fully their responsibilities to the public, to the investor and to the employee, and have tried at all times to balance these interests. We believe the time has come when the holders of our securities must actively interest themselves in the protection of their property."

*In a report to shareholders.

Studied Motor Loading Cuts Electricity Bills

Proper motor loading has long been recognized as an important element in power-factor correction, but its value as a reducer of energy cost has been too much and too long disregarded. For example, in one department of a large Middle West automobile factory complete revision of motor drives was undertaken. In all, 704 motors were affected. Many were shifted about and others were replaced, with the result that the connected load was practically halved.

The power factor of the departmental load was raised considerably, but the improvement in the total plant power factor was only slight. It was too small, in fact, to have any effect under the power-factor clause of the rate schedule. Yet it was conservatively estimated that the revision caused a reduction of about $1,100 annually in the bill for electricity. The cost of the motor-drive revision was $3,130 and it had already been justified by an annual saving in capital cost of $1,500. At the time of the motor change the total plant load factor represented 400 hours use of maximum demand per month. After the change motors totaling 878 hp. did the work that before was done by 1,710, indicating that the load on the motors in reference to their rating was practically doubled. If that doubling occurred at from quarter to half load motor efficiency was much increased. If it was from half to full load efficiency was less improved. For conservatism the latter case was assumed.

For the types and sizes of motors concerned, the range of efficiency rise due to increase from half to full load is approximately 5 per cent. As a mean assumption the rise was taken to be from 87 to 90 per cent. The input of 753 kw. for the motors before the change was thus reduced to 728 kw. after the change, a drop of 25 kw. in the total plant demand. On the basis of 400 hours use of demand per month the energy consumption was reduced by 10,000 kw.-hr. At the place in the rate schedule where these reductions applied the charge per kilowatt of demand per month was $2.50 and the rate per kilowatt-hour $0.00377. The net monthly bill reduction, including a 9 per cent prompt payment discount, on these terms was

$$(25 \times 2.50 + 10{,}000 \times 0.00377) \times 0.09 = \$90.18.)$$

Therefore, using very conservative assumptions as to the benefits of improved efficiency effected by the motor revision, there was, in addition to the reduction in capital cost amounting to $1,500 per year, a further annual saving of $1,100 in the cost of electric service. The total of these, $2,600, is a pretty fair annual return on an investment of $3.130.

115-Volt Mercury-Vapor Lamp Proves Highly Efficient

Newly Developed High-Pressure Source Performs Well in Trial Installations

By ARTHUR V. SMITH

Electrical Engineer, Spanner Vapor Lamp Company, Inc., New York

MERCURY lamps operating at low vapor pressures (of the order of 2 mm.) have been extensively used for years for space lighting. Mercury lamps operating with vapor pressures in the region of atmospheric values are comparatively new for general illumination and have materially different characteristics. Their efficiency is higher, they afford a much closer approach to daylight quality and, now that they have been made to operate satisfactorily on 115 volts, they at least appear to offer excellent opportunity to resume the forward march of highway illumination by offering municipalities more than twice as many lumens per kilowatt-hour as they have been able to get from filament lamps.

While practical lamps employing mercury vapor at the higher pressures are new, the possibility of such functioning dates back to 1904, when Kuech found that a high-presure arc was possible in a quartz tube by letting the vapor pressure rise under the influence of the hot spot on the mercury pool and providing less condensation surface than had been customary with low-pressure lamps. Under these conditions the pressure rises rapidly (Fig. 1) with the temperature, reaching atmospheric pressure at 760 mm. at 357 deg. C., the boiling temperature of mercury.

That this high-pressure region was not explored and not exploited until recently is probably due to the peculiar behavior of the arc as to lumen efficiency. Studies indicated a maximum efficiency of about 12.5 lumens per watt at about 10 mm. vapor pressure. At higher pressures the efficiency drops off rapidly (Fig. 2). The point not appreciated until lately is that there is a second point of inversion at about 20 mm., above which the lumens-per-watt efficiency rises very rapidly. At 760 mm., atmospheric pressure, the efficiency is about 50 lumens per watt, or about 2½ times the luminous efficiency of gas-filled tungsten lamps.

This high efficiency, coupled with considerably more red and yellow in spectral emission than is characteristic of the common low-pressure mercury-vapor lamp, gives the high-pressure lamp an enlarged potentiality for highway lighting, floodlighting, general space illumination, etc. European 230-volt installations, notably that at Wembley, England; extensive installations in London streets and in several vehicular tunnels, have confirmed the effectiveness of these lamps. Practice there is largely based on 400-watt lamps developing 16,000 lumens (i.e., 40 lumens per watt) with reactance ballast absorbing about 5 per cent of the applied wattage. Starting voltage is about 150 volts; lamp running voltage about 160, the rest taken up by the ballast. Life under those conditions is established at 1,500 hours.

American practice, at least as to multiple systems, demands 115 volts operation, and only recently has a lamp for this service been perfected. It is expected that its life can be set at 2,000 hours, although more time than has so far been available will have to be allowed for authoritative life tests to substantiate that value. Tripled efficiency and doubled life as compared with filament lamps for highway lighting should certainly have appeal as a means of reversing the trend toward municipal economy and curtailment in street lighting. Much more light for a little money would undoubtedly be the ultimate outcome if the present stringency could be met by now offering a bit more light for a bit less money.

Successful 230-volt installations have been made abroad in highway lighting service with 400-watt mercury lamps delivering 40 lumens per watt. It is only recently, however, that 115-volt sources have been developed capable of comparable efficiencies and the low pressure lamps have better color values than the higher pressure units. All part of contemporary history in the general advance of gaseous discharge sources.

Functioning of the Spanner lamp on 115 volts is made possible by more effective activation of the electrodes, by proper pressure of the inert gas filling and by a conductor which extends (Fig. 3) down the outside of the tubular glass bulb to the lower electrode. At the upper end it comes in such close proximity to the upper electrode inside the glass as to create a high voltage gradient which ionizes the inert gas in the tube and starts a glow

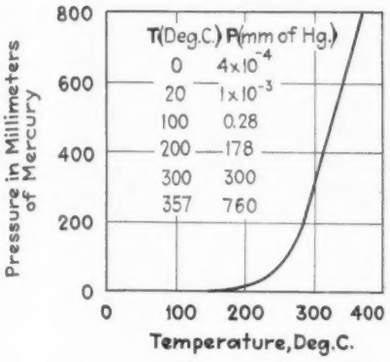


Fig. 1—Vapor pressure rises rapidly above 200 deg. C.

At zero the mercury vapor pressure is only 0.004 mm., at 100 deg. C. it has become 0.28 mm., but it shoots to atmospheric pressure at 357 deg. C., the boiling point of mercury.

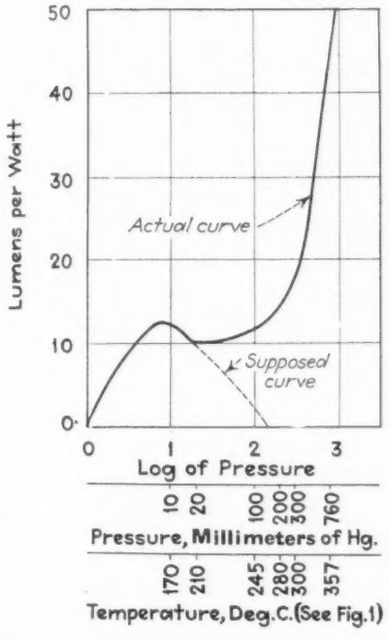


Fig. 2 — Advantageous efficiency characteristic long overlooked

Definite drop in efficiency beyond 10 mm. and 170 deg. C. discouraged research that later, however, disclosed abrupt rise in efficiency above 200 mm. and 280 deg. C.

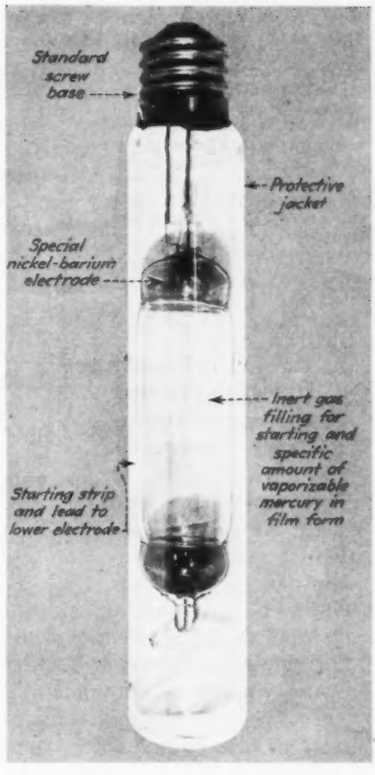

Standard screw base
Protective jacket
Special nickel-barium electrode
Inert gas filling for starting and specific amount of vaporizable mercury in film form
Starting strip and lead to lower electrode

Fig. 3 — High-pressure mercury-vapor lamp is self-starting on 115 volts

Outer glass inclosure is partly to protect inner working tube against sudden drafts, but primarily to inclose the bare strip lead to the lower electrode. Glow discharge is started (and followed by argon and mercury arcs) by high voltage - gradient where strip is adjacent to the upper electrode and ionizes the argon gas. This lamp is the invention of the Dr. Hans J. Spanner Laboratory of Berlin. It is characterized by the use of solid, self-heating activated single lead-in wire electrodes, a filling of inert gas at proper pressure and of a specifically determined amount of vaporizable metal, the starting strip and the properly shaped tube all mounted in a protecting jacket on a standard screw base.

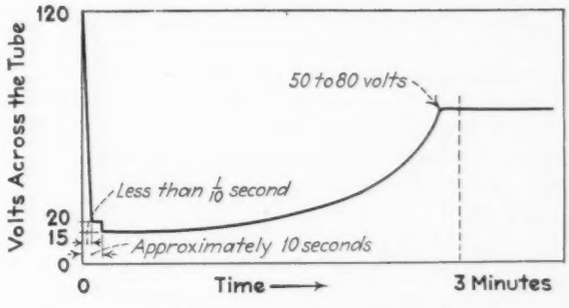


Fig. 4—Arc quickly replaces gas glow with rise in pressure, arc voltage and temperature

discharge between electrodes as soon as the light is switched on. The glow voltage in $\frac{1}{10}$ second drops to the 20-volt arc value for argon and in about ten seconds the mercury arc strikes and another 5-volt drop to 15 volts, the characteristic voltage for mercury vapor in a cold tube, takes place (Fig. 4). Just enough mercury is available in the properly dimensioned tube to bring the pressure up to about atmospheric values as the accumulating heat evaporates all the globules and raises the vapor pressure. The voltage during the three minutes required for this process in a 100-watt tube rises to between 50 and 80 volts and is thereafter stable at this value.

Short time delay in light emission

De-energizing the tube for more than a few cycles will result in extinction of the arc and from five to fifteen minutes will be required for its re-establishment. This time varies, depending upon the heat dissipation (surface area, room temperature, etc.) and the time required for mercury condensation and consequent drop in vapor pressure to the point where reignition can take place. Recent studies indicate that this time can be substantially shortened. Naturally the research on this feature will be prosecuted to render the high-pressure mercury lamp as prompt in lighting up as the filament lamp.

Higher vapor pressure is the result of the higher temperature in the arc space. There is just enough mercury in the tube to establish the desired vapor pressure at the temperature which results. The outer glass shell protects the inner bulb against sharp drafts and at the same time incloses the live conductor (starting strip) down the side of the working tube. Along with the higher temperature of the high-pressure lamp (in contrast with the low temperature of the low-pressure lamp) goes a pronounced change in the emitted radiation. The visible mercury spectrum is composed of five principal lines and several less intensive ones. These five chief lines are a violet line (4,047 λ), blue (4,358 λ), green (5,461 λ) and two yellow (5,770 and 5,791 λ). At the low temperature-pressure stage the major portion of the luminous energy is in the blue-green area, giving it a resultant blue color characteristic of that lamp. As temperature and vapor pressure rise the yellow and orange lines are intensified (Fig. 5) at a more rapid rate than the blue-greens and violet; the spectral energy distribution is progressively moved toward solar spectral distribution. As the pressure reaches about one atmosphere some faint red lines appear and also a faint continuous spectrum becomes evident.

The lamp admittedly remains deficient in the red and therefore exhibits a greenish-white tinge. In combination, however, with a filament lamp of appropriate wattage the result is a form of synthetic daylight because the predominant red of the filament lamp compensates

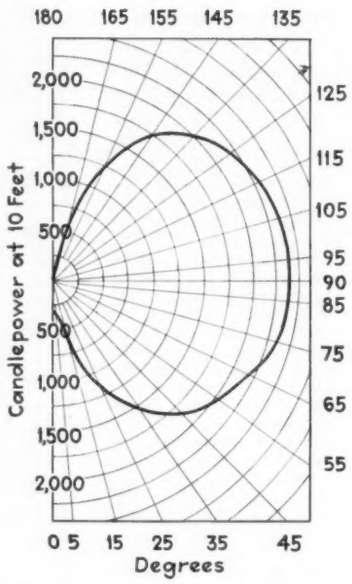


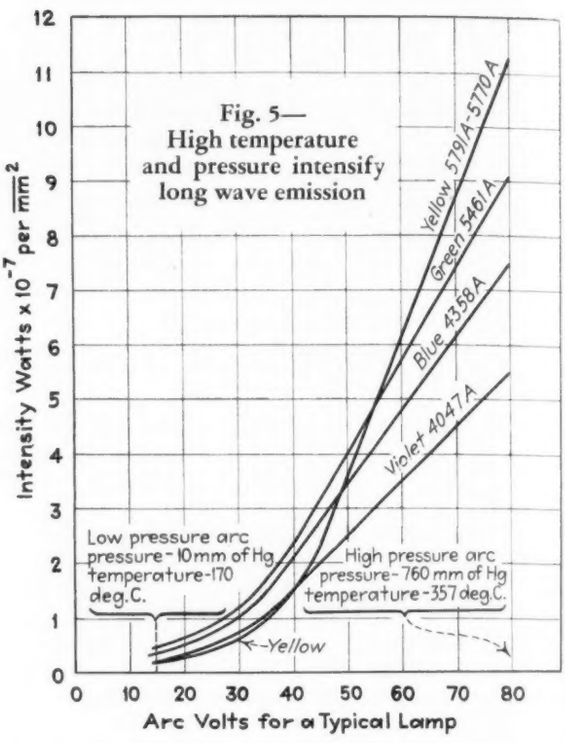
Fig. 6—Greatest light at right angles to tube

Above curve (by Electrical Testing Laboratories) is for 500-watt input, at which the lamp voltage was 92, amperes 5.98 and power factor 0.91. Lumen output was 25,089, giving an efficiency of 50.1 lumens per watt.

for the red deficiency of the high-pressure mercury-vapor lamp.

Various proposals have been made to combine vapors and gases so as to pool their spectral predominances and thus obtain a sunlight substitute. With a mixture of gas and vapor or of two vapors, this is a difficult task. The one—gas or vapor—which inherently requires the lowest voltage to stimulate it will swamp the luminescence from the others. Further, a gas will show up most at the cathode and the vapor will be luminous mostly in the long positive column. Where temperature and pressure ranges are involved it is even more difficult to preserve the balance in emission, because the gas will predominate at the low pressure and temperature and the vapor at the higher pressures and temperatures. As it is, the color rendition of the high-pressure mercury-vapor lamp is good except for red objects whose color shows up as a brownish purple because of the very low red component from the mercury vapor.

It has been possible, by the use of proper glasses, to make similar lamps containing sodium, cadmium, rubidium, indium, gallium, zinc, etc., alone or in mixture. Argon, neon, helium and zenon have been used as gaseous fillers for their characteristic spectral contributions.



Starting and running voltage are of the same order of magnitude. This is a feature of practical significance for highway and general illumination. The lamp requires no starting or regulating auxiliaries other than the reactance ballast inherently required because of the negative resistance characteristic of gas and vapor arcs in general. Even this ballast may be dispensed with in the event that the mercury lamp is operated in series with a filament

Fig. 7—Spanner high-pressure mercury-vapor lamps in street-lighting, façade lighting and interior illumination

Left—Six 300-watt lamps in multiple on 231st Street, New York City. Right—Two 200-watt lamps on 30th Street. The lamps in the distance are 500-watt incandescents.

lamp with its counterbalancing characteristic. Experimental lamps have incorporated the filament in the gas-filled outer jacket. Flicker at 60 cycles is slightly noticeable in case of rapidly moving objects. This is, however, much less than on the 50-cycle European system, where it has not proved to be a deterrent to use of the lamps. It occurs because of the sharper response to the vapor (due to the lack of means for energy storage) to cyclic energy variations than does the filament with its thermal carry-over.

New York City has four installations of these 115-volt high-pressure mercury-vapor lamps. One consists of two lamps on 30th Street, installed on the multiple street-lighting system of the New York Edison Company. They were placed in operation on March 17, 1934, at the direction of Commissioner Maurice P. Davidson of the Department of Water Supply, Gas and Electricity and Chief Engineer Nicholas Kelly of the department. Another installation (February 16, 1934) consists of six 300-watt lamps on standards on 231st Street in front of the Spanner laboratories. Also three of these lamps are being used to floodlight the front of a garage in the Bronx. One of the corridor lobbies in the Municipal Building has two 400-watt mercury units.

Interchangeable Meter Mounting Now an Accomplished Standard

An assignment has been undertaken by a working group of the electrical equipment committee of the Edison Electric Institute to bring about simplification, interchangeability, reduced cost and greater security against energy diversion in the mounting of customers' meters. The importance of this objective was emphasized in a letter to the editor, entitled "Simplified Meter Mountings Under Study by E.E.I.," published in ELECTRICAL WORLD of February 24, 1934. The working out of a schedule of basic requirements co-ordinating as many as practicable of the large diversity of meter installation practices was recognized as the key to the answer sought. Faced by this diversity of practices, meter manufacturers had found little encouragement to work for interchangeable standards.

The meter mounting and energy diversion subcommittees, at a joint meeting in Cincinnati on March 30, 1934, agreed upon a schedule of basic requirements applicable to single-phase watt-hour meters and a common mounting device. The committee on metering and service methods of the Association of Edison Illuminating Companies was consulted and its support obtained.

The schedule of requirements accomplished, the representatives of the utility groups met with representatives of the four meter manufacturers, describing their objective, presenting their schedule of basic requirements and requesting co-operation, this co-operation being immediately pledged.

Manufacturers responded promptly, proposing a solution at a joint meeting held in New York City on May 2. This proposal was received favorably by the electric light and power group and the manufacturers were advised to proceed at once with its execution. The manufacturers gave full assurance that the working out of all remaining details of design would be expedited and the new standard meters made commercially available very promptly. Orders will be accepted at once.

Interchangeable standardization summarized

This new interchangeable standardization briefly may be defined as follows:

1. Henceforth all four manufacturers will offer two standard single-phase meters:

Type A—A bottom-connected meter similar to and interchangeable with the present type A line manufactured by the General Electric, Sangamo and Duncan companies.

Type S—A so-called socket or detachable meter, similar to and interchangeable with the present Westinghouse CS meter.

2. This standardization applies only in matters of meter housing and connection terminals. It does not in any way concern the mechanisms and characteristics of the meter proper.

3. The aim for the standard interchangeable meters, types A and S, will be the maximum simplicity and economy consistent with effective and satisfactory operation.

4. The present type B and C lines of equipment now manufactured by the General Electric, Sangamo and Duncan companies will be continued.

Some question has been raised concerning the manufacturers offering two standards instead of one. It is generally felt, however, that this is desirable. Regardless of the type and design of a new meter mounting to meet the requirements as presented, there would undoubtedly continue an appreciable demand for an open-terminal chamber, bottom-connected meter interchangeable with and similar to those that have been used for several years. It will be a definite gain therefore for this meter to be standardized among all of the manufacturers, in addition to the fully standardized new method of mounting which fits in well with the modern trend in meter installations and service wiring.

Meter purchases can now be planned

This agreement on meter standards clears the way for the operating companies intelligently to plan their house meter policies and pending purchases. It is in the simplification and unification of practices of meter installation and maintenance that the major opportunities for economies exist, although this unification should lead to substantial savings in the purchase price of the equipment. The users are counseled to give prompt, although deliberate, consideration to determining how best to realize the benefits available from this standardization. The earlier and more earnest the response to the new standards, as reflected by the purchases of the utilities, the sooner will the full benefits of consolidation and quantity production become available.

The very definite and increasing trend to the outdoor location for the meter emphasizes the need that meter mounting practices be co-ordinated with service entrance practices. This problem of service entrance practices has been included in the undertaking of the E.E.I. meter mounting and energy diversion subcommittees. The agreement on the types A and S standard interchangeable meters clears up a major item and enables concentrating on the service run and service entrance features.

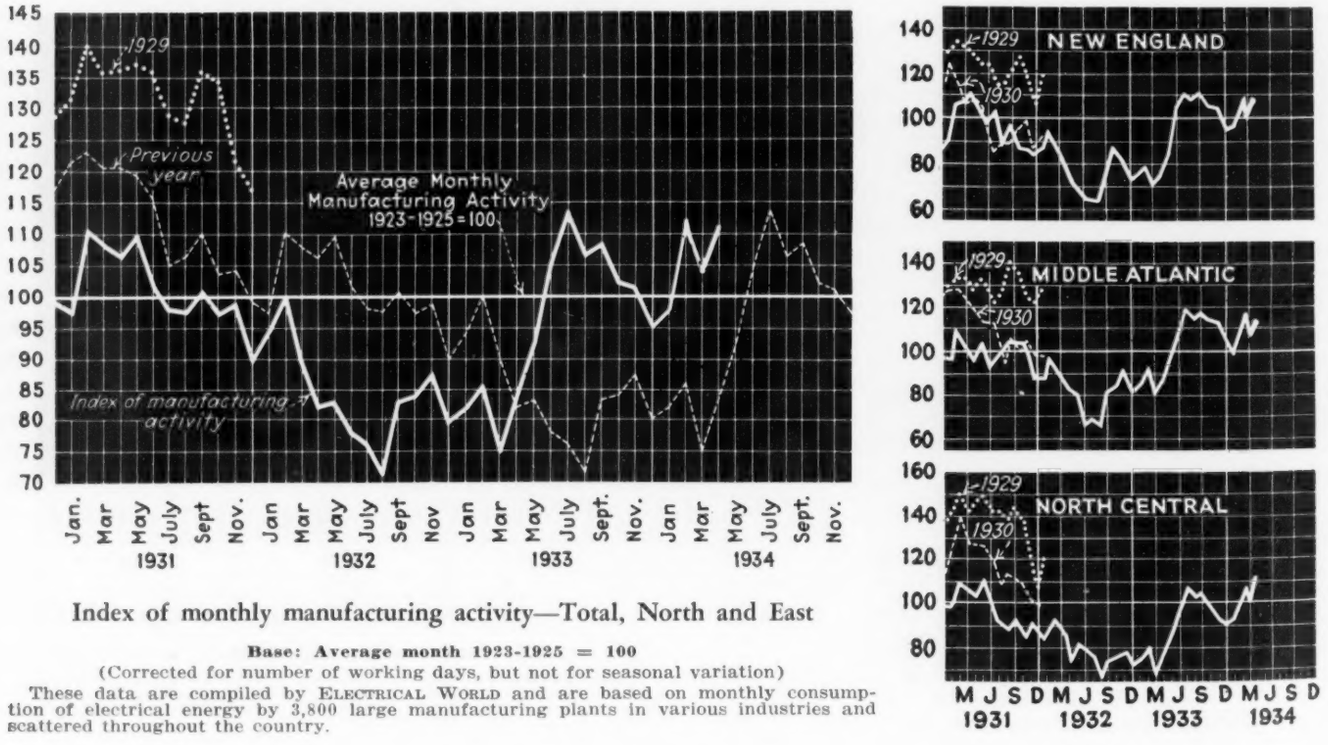
April Brings Rise in Factory Energy

Gain in industrial energy use during April is shown by *Electrical World's* monthly survey. Operations were the highest for the month in three years and surpassed those of 1933 by 32 per cent. Iron and steel mills are steadily increasing their activity, while automobile plants report the highest month since early 1930.

OPERATIONS in virtually every type of industrial plant are on the up-grade. All of them, with the single exception of the food industries, are far above the rate prevailing a year ago. This is evident from returns received by ELECTRICAL WORLD in its monthly survey of energy consumption during April in industrial plants, accounting for 1,250,000,000 kw.-hr., which is equivalent to about half the total energy sold by public utilities to wholesale consumers.

These returns show the highest rate of April operations since 1930. The increase over the same month in 1933 was 32 per cent; over 1932 it was 35 per cent, and there was a small gain compared with 1931. The average for the first quarter of 1934 was exceeded by 7 per cent. In the accompanying tables relative figures, in each case compared with the average month during 1923-1925, are given for thirteen industry groups, first for the United States as a whole and then reclassified by geographic divisions. To take into account differences in the number of working days in the various months adjustments have been made so that the figures will be comparable. This was discussed in the ELECTRICAL WORLD of April 21, page 582, in connection with the returns for March.

The most striking changes from 1933 appear in the automobile, rubber, iron and steel and metal-working industries. These gained, respectively, 86, 74, 56 and 63 per cent. Moreover, there have been general gains over the averages for the first quarter, the four industries named being higher in April by 15, 4, 14 and 7 per cent.



Index of monthly manufacturing activity—Total, North and East

Base: Average month 1923-1925 = 100

(Corrected for number of working days, but not for seasonal variation)

These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,800 large manufacturing plants in various industries and scattered throughout the country.

Industrial Groups	United States Apr., 1934	United States Mar., 1934	United States Feb., 1934	United States Apr., 1933	New England Apr., 1934	New England Mar., 1934	New England Feb., 1934	New England Apr., 1933	Middle Atlantic Apr., 1934	Middle Atlantic Mar., 1934	Middle Atlantic Feb., 1934	Middle Atlantic Apr., 1933	North Central Apr., 1934	North Central Mar., 1934	North Central Feb., 1934	North Central Apr., 1933
All Industry	**111.3**	**104.0***	**112.0**	**84.4**	**108.4**	**101.1***	**110.2**	**73.8**	**113.5**	**108.9***	**117.8**	**86.3**	**111.0**	**103.0***	**109.8**	**79.8**
Automobile (incl. parts and accessories)	102.0	91.4*	95.5	54.8	....	....	....	....	90.7	85.5*	89.2	50.6	102.7	92.2*	96.2	55.5
Chemical products (incl. oil refining)	161.4	149.7*	162.8	121.0	186.4	142.0	172.0	143.0	176.5	162.3*	171.3	124.6	131.0	120.0*	145.1	115.7
Food products	118.8	107.2*	117.5	119.7	....	....	....	....	121.0	111.7*	122.5	123.0	114.7	101.6*	112.0	115.6
Iron and steel	97.2	90.5*	89.3	62.3	132.2	121.6*	114.3	81.2	86.0	81.9*	88.0	46.8	102.2	93.8*	87.2	71.8
Metal working	90.1	85.0*	88.6	55.3	119.7	110.0*	121.1	68.7	74.4	70.5*	71.8	52.3	103.0	97.1*	100.2	55.7
Metals group	92.8	87.1*	88.9	58.0	123.2	113.2*	119.0	72.3	79.5	75.5*	78.8	50.0	102.7	95.8*	95.3	61.8
Leather products	105.0	99.0*	124.3	82.5	99.8	89.8*	112.7	73.3	113.6	111.3*	156.0	104.2	99.8	92.6	100.2	67.9
Forest products	110.5	102.3*	112.0	89.5	48.2	47.2*	50.2	38.9	68.0	62.7*	67.0	58.7	90.8	85.8	93.7	71.4
Paper and pulp	126.8	121.3*	130.3	102.3	127.5	116.0*	131.7	93.5	110.8	103.3*	108.6	74.0	110.2	106.1*	116.4	103.0
Rubber products	143.0	138.2	140.2	82.0	112.0	116.1*	113.7	69.9	....	....	....	....	151.2	146.3	146.2	80.2
Shipbuilding	85.5	85.7*	107.6	73.0	....	....	....	....	....	....	....	....	....	....	....	....
Stone, clay and glass	89.7	86.4*	88.7	74.5	....	....	....	....	76.5	59.4*	56.3	49.7	121.0	109.3*	121.5	86.7
Textiles	109.6	106.4*	119.2	86.0	84.1	84.5*	89.4	61.6	138.8	143.0*	158.7	114.4	137.0	147.0*	167.5	114.8

*Revision.

Aside from the metal industries other durable goods industries have also continued to forge upward from last year's levels. The stone group is 20 per cent higher and forest products 24 per cent.

Progress in Eastern and Central areas

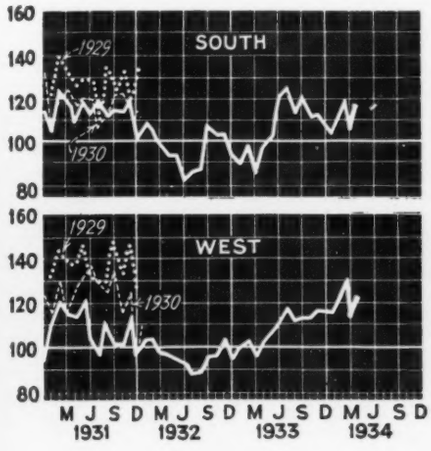
In New England the two leading industries are textiles and metal-working. The former held up to the average for the first quarter, the latter rose 6 per cent. Both are well above the rate of operations a year ago, textiles by 36 and metals by 74 per cent. These two industries contributed largely to the 47 per cent gain compared with the same month last year. Apparently in step with progress in the automotive industry in other parts of the country, the manufacture of rubber goods called for an increase of 60 per cent over the energy consumed a year ago. These are outstanding changes. But parallel with them the reports show similar progress in other lines—chemical products, iron and steel, leather products, paper. The wood industry alone is still on a low plane, though it also is doing better than in 1933.

The story of New England is repeated, with variations, in other sections. The Middle Atlantic average was raised 32 per cent over 1933, largely by progress in steel, metal-working, textiles and chemical products. In the North Central area a 39 per cent gain was due primarily to the great acceleration of the automotive, steel and metal-working industries; the first and third rose 85, the second 42 per cent. Foods remain at last year's level. All others advanced.

South and West exceed quarterly averages

The April average for the South surpassed the first quarter's average by 8 and for the West by 3 per cent. Corresponding gains over April, 1933, were 19 and 20 per cent. In the former, iron and steel mills are working 58 per cent above the rate reported a year ago; textile plants are up 20 per cent. It is worth noting that with the exception of metal-working and forest products all industries in that section are well above the 1923-1925 average, which was far from being the case last year.

The Western reports show recession in one industry only—shipbuilding—with all other lines above the quarterly averages and also above last year's April figures.



Index of monthly manufacturing activity, South and West

Base: Average month 1923-1925 = 100

(Corrected for number of working days, but not for seasonal variation)

Industrial Groups	South				West			
	April, 1934	March, 1934	Feb., 1934	April, 1933	April, 1934	March, 1934	Feb., 1934	April, 1933
All Industry	**118.8**	**106.0•**	**120.4**	**99.8**	**123.2**	**116.5•**	**126.3**	**103.2**
Chemical products	169.5	157.0•	178.0	132.0	91.7	85.2•	91.6	82.4
Food products	141.5	123.7•	143.0	148.2	124.0	118.6•	130.1	121.0
Iron and steel	155.2	133.5•	135.7	98.5	....	....	....	....
Metal working	92.2	8.5	98.5	59.9	....	....	....	....
Metals group	127.4	114.2•	119.3	81.5	76.7	71.6•	74.7	47.5
Forest products	46.7	42.1•	50.3	37.2	176.8	165.6•	177.2	142.0
Paper and pulp	158.5	161.0•	171.3	141.4	168.5	159.5•	161.0	130.0
Rubber products	104.7	97.0•	114.8	101.7	117.0	109.0•	108.0•	56.2
Shipbuilding	....	....	....	....	97.2	113.0	148.4	105.4
Stone, clay and glass	145.4	130.1•	122.5	145.3	121.2	111.3•	125.0	91.0
Textiles	127.3	115.0•	135.7	105.8	....	....	....	....

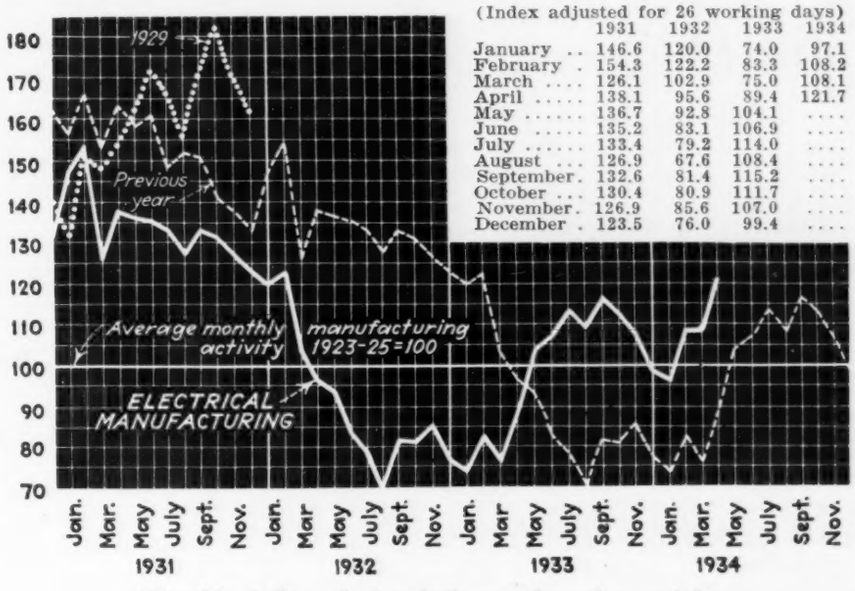
•Revision

Electrical Manufacturing Activity Rises

Reports from establishments engaged in the manufacture of electrical goods show an advance of 12 per cent in the rate of energy consumption during April compared with March. Although there were fewer working days in April, the group of smaller manufacturers used more energy. When the figures are adjusted to take this difference into account an increase of 14 per cent is shown, while the large concerns show a smaller increase. Both groups are far above the rate of operations a year ago, and the industry as a whole has risen 36 per cent.

In the North Central area, in particular, the manufacture of appliances is evidently forging ahead. Most of the figures from that region are considerably above those for March, and the total energy used jumped 15 per cent, although April was a shorter month.

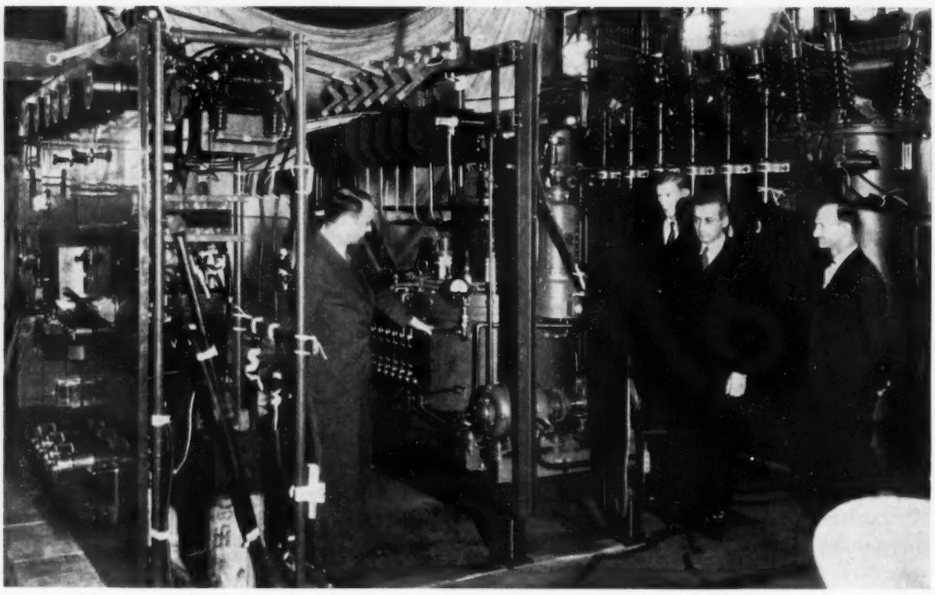
Operations in April Were the Highest Since Early 1932



(Index adjusted for 26 working days)

	1931	1932	1933	1934
January	146.6	120.0	74.0	97.1
February	154.3	122.2	83.3	108.2
March	126.1	102.9	75.0	108.1
April	138.1	95.6	89.4	121.7
May	136.7	92.8	104.1	....
June	135.2	83.1	106.9	....
July	133.4	79.2	114.0	....
August	126.9	67.6	108.4	....
September	132.6	81.4	115.2	....
October	130.4	80.9	111.7	....
November	126.9	85.6	107.0	....
December	123.5	76.0	99.4	....

Monthly index of electrical manufacturing activity



Ready to ship the first American-made unit

High - voltage grid - controlled mercury-arc rectifier with associated equipment is set up for demonstration to interested engineers in the Allis-Chalmers plant. O. K. Marti, who pioneered the development, was not able to be present when this picture was taken. However, his able assistants are shown. They are, left to right, W. E. Gutzwiller, S. R. Durand, H. Winograd and I. K. Dortort.

Rectifier Clears Faults in Fraction of a Cycle

This grid-controlled mercury-arc rectifier of over 250 kva. serving a radio load was short circuited by wire almost as fine as a hair. The output was cut off before the wire had time to fuse. A step toward generally faster circuit interruption?

Recent demonstrations of the first high-voltage grid-controlled mercury-arc rectifier manufactured in the United States were witnessed by power system engineers before its shipment from the Allis-Chalmers plant at Milwaukee. They were impressed by the amazing speed of the fault clearance by protective equipment built into the apparatus. The rectifier, which was built for radio transmission application, has a direct-current output voltage of 25,000 and has been tested at higher potentials. It will deliver 1,000,000 watts. While this is the first rectifier of this type made in the United States, about three dozen have been manufactured by the Brown-Boveri Company and it has been adopted by all of the larger manufacturers of radio-transmitting equipment in Europe.

As stated, an outstanding feature of this rectifier is that it can automatically protect radio equipment by cutting off power in less than one cycle, can clear a flashover in the transmitter and automatically replace power in less than one-tenth of a second thereafter. An interruption of only about one-tenth of a second could hardly be noticed in a broadcast program, whereas programs now are occasionally interrupted for several minutes because of flashovers in tubes or across condensers in the transmitter. Another feature of the rectifier is that by its grid control the direct-current output voltage can be adjusted to any value between maximum and zero. This eliminates the necessity of using voltage regulators or transformer tap-changing switches, which are expensive items.

Oil Maintenance Essential

Just how important the proper maintenance of oil is, used in the lubricating and governor systems of steam power plants, has been well shown by the official report of a turbine failure in Wales. Periodic filtering and conditioning of the oil, or the use of continuous equipment, such as screens or filters on the oil system, are approaches to the solution of the problem.

The failure of a 5,000-kw. turbo-generator unit at the Ifor station in Dowlais has, upon investigation by engineers of the British Home Office, been attributed to sediment and fouling in the oil system rather than to construction of the rotor or to operators' errors. The machine was one of two 5,000-kw., 6.6-kv., 50-cycle, 3,000-r.p.m. units (installed in 1923) and had been in operation continuously for about four months at the time of breakdown. The load was 1,500 kw. at the time and the speed rose to more than 4,000 r.p.m., causing the complete failure of the unit and building damage.

Both the regular and emergency governing systems were found to have been inoperative at the time of failure. The governing system consisted of a spring-loaded governor, a rotary pump supplying oil under pressure to the oil pot of each throttle valve and at reduced pressure to the bearings. The emergency governor consisted of a spring-loaded plunger housed in the turbine shaft, which at 10 per cent overspeed is ejected and strikes a bell-crank lever, causing a spring-controlled spindle to trip the main stop valve and close the throttle. The plunger had ejected, but fouling or abnormal expansion had prevented the spindle from functioning. The main governor, meanwhile, had permitted excessive speed because of the shearing of a small screwed bolt from which the governor sleeve links were suspended and the blending of a similar bolt to which the outer jaw of the fork of one of the rockers of the link gear was connected; this jaw was sheared off. Evidence was found that some foreign body had caught between the inner jaws of the rocker and the boss of the governor. The finding of considerable sediment in the oil system bore out this theory and accounted for the spindle sticking.

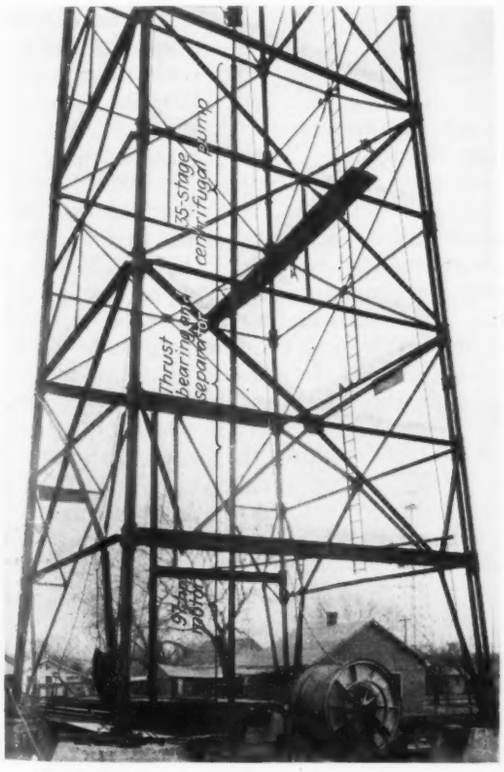
Oil-Well-Bottom Pumps Bring "Lead-Pencil" Motors

To build highly efficient 97-hp. motors 20 ft. long and less than 8 in. in diameter is a notable triumph for the design engineer. Then drop them a mile or so below the surface of the earth in drill-holes and oil production may be made with economy under today's rigid regulations on output. In a word, electricity is just doing another difficult job here surpassingly well.

DOWN into the earth to depths of around 6,500 ft. are going increasing numbers of startlingly slim and elongated motor and pump units to raise oil to the surface. Back a few years ago, in the enthusiastic days of reckless oil production before government dealt itself a hand in the game, the best way of getting oil out of the ground was the way that could most quickly be put into operation. There was little opportunity for that testing out in actual operation which is the final necessity in the complete development of something new, and thus the deep-well electric pump was denied for a time the chance adequately to prove itself in practice. However, the new pump has had that chance in the past year or so and with the "bugs" pretty well eliminated it is apparently "going places."

Probably the new type of unit, known as the Reda pump, whose appearance and design are shown in the accompanying illustrations, has had its largest application so far in the Oklahoma City oil field, where the wells are very deep. It has been estimated that of the approximately 900 wells in this area probably 300 could use the pump to great advantage. The average running time based on allowable production at this time is about seventeen days per month per well. A pump such as is illustrated here will cost about $10,000, including the feed cable, and will raise in the neighborhood of 1,000 bbl. of oil daily, using about 2,200 kw.-hr. per day with a demand averaging about 90 kw.

The electric pump is not significantly more efficient than the usual



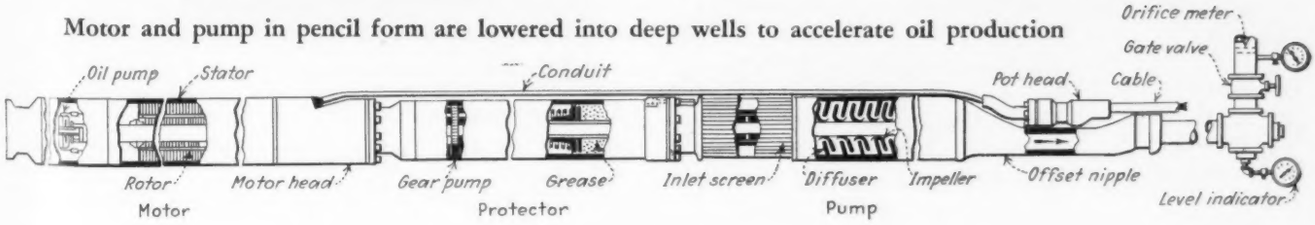
The pump ready for work

The lower 20 ft. of the long, slender pipe hung in the center of the derrick, ready to drop into the well, is a 97-hp. electric motor. Next above it is a thrust bearing and 4-in. gas separator and the top 20 ft. is a 135-stage centrifugal pump. The motor feed cable passes up over a sheave and down to the pay-out reel in the foreground.

On the way down—a close-up

The motor is almost completely in the well casing and has been held for a picture to show the attachment of the feed cable. Above the motor are the Kingsbury thrust bearing and the gas separator with just the lower end of the centrifugal pump showing above them. The well into which this pump is being lowered has a 9-in. casing and the unit itself has a diameter of less than 8 in.

Motor and pump in pencil form are lowered into deep wells to accelerate oil production



gas engine and walking beam unit, which costs about the same amount of money, but the latter will produce perhaps only a maximum of 300 bbl. per day and therefore the allowed production quota per well cannot be reached in the specified number of well-operating days. The electric pump thus has a very large production advantage. The third method of raising oil—gas lift, in which petroleum gases at about 600 lb. pressure are forced into the well through a center tube inside the well casing and the oil rises in the annular space surrounding the tube—has no limitation of production. But the average cost of pumping will run to 10 to 12 cents per barrel when all factors are considered, and this is rather a high cost.

Hospital Elevator Vibration Cut by Rubber Mounting Pads

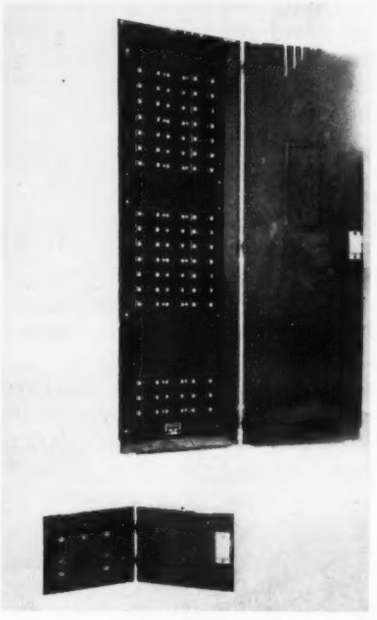
Motors of four elevators in a large hospital have been mounted on rubber pads and the elimination of noise and vibration has been so complete that the adjacent private rooms can now be used for sick patients. This scheme proved far cheaper than any other feasible means of controlling the effects of vibration from armature teeth and the sheave shaft bearings. The total weight carried, motor, cable, car and load, is about 30,000 lb., the elevators are rated at 3,500 lb. and speed is 400 ft. per minute.

Placing the pads under the ends of the elevator machine support beams leaves the relation between driving and secondary sheaves unchanged and the tilting effect and pressures are minimized. The pads are about 7 x 8 in. and 2 in. thick, of B-7620 rubber made by Manhattan Rubber Manufacturing Division of Raybestos-Manhattan, Inc. These dimensions, in conjunction with the elastic properties of the material, give the supported mass a natural frequency of about 12 cycles per second, low enough to avert resonance. Flexibility of the hoist rope is such as to take the car and counterweight out of the picture in establishing a natural frequency of the supported mass. The stiffness of the rubber was so chosen as to give the value at the load point the same proportion to the total stiffness as the reaction at the load point bears to the total load reaction.

Measurements during operation indicated the support beams were out of level only $\frac{3}{64}$ in. between points 9 ft. 6 in. apart. Maximum compression of the pads was $\frac{1}{4}$ in. Vertical movement at starting and stopping is between 8 and 10 mils and setting the brake causes a 3 to 4 mil movement. The greatest sideways movement observed was from 10 to 12 mils, but quickly damped. On the whole, observers in rooms adjacent to the elevator machines could not tell whether the elevator was operating.

Experiments to fix the pad size and properties were conducted in the General Electric Research Laboratories by E. H. Hull. The Haughton Elevator & Machine Company did the installation work under the direction and designs of Kaiser, Muller & Davies, consulting engineers.

Low-Cost Preset Lighting With Small-Breaker Panel



Master switch with breaker panel offers preset features

Where various combinations of lighting may be called for frequently, such distribution panels as illustrated and used in the University of California gymnasium will prove economical and just as effective as a complicated control panel. Instead of the conventional fuse box, no-fuse circuit breakers were used. Lighting circuits are grouped into five sections, each section being controlled by a remote control master switch, the push buttons for which are shown in the small cabinet directly below the load center, where the presettings are made.

The need for various combinations of lighting in the gymnasium varies with the particular type of activities called for in the physical training program. With the no-fuse circuit breakers in the load center, it is possible to close the circuits which will give the most effective lighting for the particular sport in play, and then press the push buttons controlling the master switch for the various sections. In this way a flexible, preset, lighting installation is obtained without any additional cost. The idea can be applied to any building large enough to require a number of separate lighting circuits and in which sectionalized lighting can be used economically and to direct advantage.

Rotating Magnets Feed Steel Pins to Machines

By H. H. RAYMOND
Consulting Engineer the Stanley Works, New Britain, Conn.

Bolts, hinge pins and other elongated head items of steel are magnetically handled at the Stanley Works without danger of jamming productive machinery by the rotating aluminum ring shown in Fig. 1, between the feeding hopper and the gravity track slide leading to

IN INDUSTRY

Fig. 1—Economical delivery of steel pins from hopper to feeding track by electromagnetic pick-up and discharge

the tool. The ring is about 28 in. in diameter; it revolves at eleven revolutions per minute and carries six electromagnets with pole faces flush inside the rim. Direct current at 110-volts is provided through a commutator at the rear of the ring, and about 0.5 amp. suffices to energize a magnet.

As each successive electromagnet revolves it picks up current from the commutator when the magnet is in the bottom position. It picks up a pin or bolt by the head and carries it around to the top position, where the pin meets a forked head leading to the gravity runway.

Current is automatically broken by the commutator, de-energizing the magnet and releasing the pin to drop into place on the runway. Should the machine below stop taking work from the runway the pins are simply pushed off to drop back into the hopper, thus avoiding the jamming troubles frequently encountered in hopper feeding devices.

The aluminum ring is the only moving part and this is designed without projections to catch the work. If a piece happens to hang head down it falls back into the hopper on reaching the forked entrance to the runway. One brush per magnet revolves with the ring, making contact with a stationary commutator ring for half its revolution. The point where the pins drop off from the magnets can be regulated by shifting the commutator ring, enabling the point of pick-up and delivery to be regulated to suit the work. Further, the amount of magnetic flux can be adjusted to meet a wide range of pin or bolt sizes and shapes by manipulating a hand rheostat (Fig. 2) at the rear of the aluminum ring. The forked guide is also adjustable by screw changes on the side of the hopper.

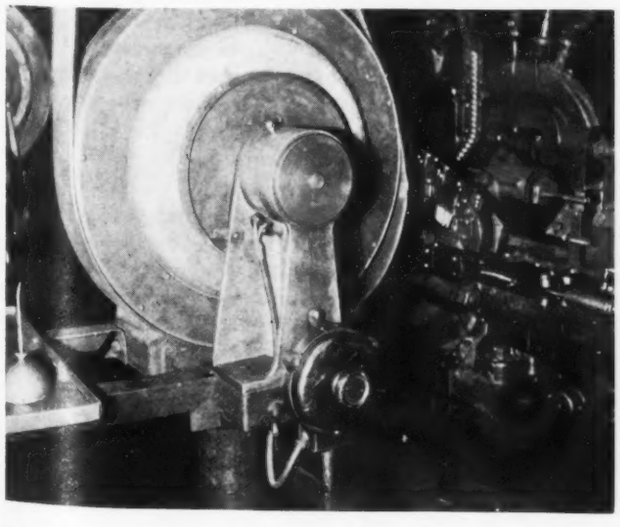
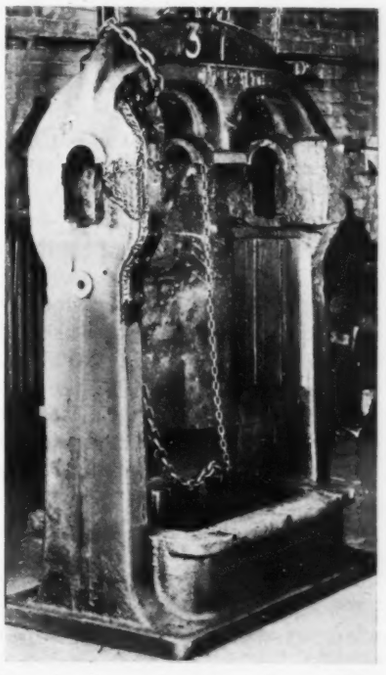


Fig. 2—Reverse side of electromagnetic carrier showing feed to commutator and hand rheostat to vary flux for different grades of work

Arc Welding Saves $200 in Repair of a Punch Press

By use of arc welding the Defiance (Ohio) Pressed Steel Company saved $200 in the repair of a cast-iron punch press frame which had broken at one bearing. The press was back in service 36 hours after the break occurred. The Menna Welding Company of Toledo prepared the break for welding by cutting away enough of the cast iron around the break to permit the insertion of a number of steel studs in order to obtain a strong, solid joint. A double layer of General Electric type A welding electrode was then applied to give a layer of metal strongly bonded to the cast iron. Type F electrode was used to fill in the remainder of the gap on both sides of the bearing because of the saving in time and cost afforded by this particular electrode. About 75 lb. of electrode was consumed in the repair.



Repaired punch press after welding job was completed

The cost of a new frame, exclusive of installation, would have been $200 greater than the cost of the welding job and the press would have been out of service for a much longer period.

We Help the Industrial User to Earn a Low Rate

Methods Employed in Philadelphia to Analyze Power Applications in Industry and to Work Out Better Economies for the Customer

By MAXWELL COLE
Director Industrial Service Division, Philadelphia Electric Company

PROPERLY constructed rate schedules result in the customer's establishing his own bill, high if he creates operating conditions which impose a heavy expense on the power company, low if these conditions permit the power company to supply him economically. With such a rate schedule any move a customer can make to improve his average cost of current effects a corresponding reduction in the power company's cost of supplying him, so why should not the power company co-operate to the fullest extent with its customer to help him earn the best rate? It is not only good business from the standpoint of the customer's good will, but can be done without sacrificing profit.

The fundamentals of any costs and consequently of the prices charged to customers are the same in any business. Roughly, they are divided into two parts—overhead and operating costs. Overhead, of course, includes capital charges on investments, sales, office, bookkeeping and similar expenses. Operating expenses include raw materials, labor and maintenance expenses and depend upon the amount of a product, be it electricity or pencils, which the seller has to supply his customer.

The fact that we must supply current to a customer continuously, that we must bill him regularly and that the manner of taking service materially affects cost, together with a legal requirement that our rates for each class of customer must be made up and filed with the Public Service Commission of our state, prevent our doing as the ordinary business does, namely, to average our overhead and operating costs and name a flat price per unit to each individual customer when he signs his contract. We must therefore prepare our rate schedules so that overhead and operating costs automatically average themselves on each bill.

These conditions are responsible for the employment of those terms sometimes so confusing to our customers, "demand charge," "standby charge," "current charge," "power factor," "kw., kw.-hr.," "fuel adjustment," etc. As terms they may be confusing to the layman's eye, but with a little study and thought they resolve themselves to those two old familiars "overhead" and "operating costs." If the bewildered customer will substitute "overhead" for "demand charge" and "operating costs" for "current charge" the bill resolves itself into a comparatively simple accounting statement.

The overhead or demand charge consists primarily of the capital charges on the equipment necessary to supply a given customer, together with the administrative and office costs. Obviously the generating equipment and all equipment facilities necessary to supply a 20-hp. motor will be nearly double those involved in supplying power to a 10-hp. motor. These facilities must be adequate to supply, at any time, the maximum call or demand which the customer will make upon them, from which was born the term "demand charge." The usage which he makes of that motor or other power load determines the operating costs. If he operates it ten hours a day he will obviously take twice as many units of our production as if he operates it but five hours and our operating costs are consequently twice as much. We measure these production units in energy or current and so call this charge "energy" or "current charge."

Load factor, another source of confusion to our customers, is but an expression that engineers have coined to name the relation between the overhead and operating costs. If a customer utilizes the full capacity of his service 24 hours a day he has 100 per cent load factor, his actual usage of our product is high in relation to our overhead and his cost per unit of consumption is low. If, however, he uses it but two hours a day the same overhead must be spread over a few units of consumption and his average rate is correspondingly high.

Demand cut by controlling connected load

How can a study of these facts be turned to advantage in lowering power costs? Where do we begin in making our study and then what can we do about it and what will the reduction amount to? As in any endeavor to reduce costs, there are two items which should first be attacked—overhead and waste. The overhead charge is usually the first item on an electric bill, so let's look at it first.

A shop has only four motors aggregating 10 hp. and the rate does not have a "demand charge." Maybe there is no separate "demand charge," but in the great majority of such rates there are steps to the current charge and the number of kilowatt-hours which have to be paid for in the higher brackets depends on the demand. For example, the rate may provide for "25

hours use" of the demand at 10 cents and the excess at 2½ cents. Every kilowatt that the demand can be cut drops 25 kw.-hr. from 10 cents to 2½ cents—a saving of 25 × 7½ cents or $1.875, which really is a "demand charge."

That is the feature of almost any rate which is most susceptible to treatment and is the first thing that should receive consideration—can we reduce the demand? The demand of such customers is usually determined by applying an assessment or percentage to the total connected load. Converting this customer's load, his 10 hp. equals 7.5 kw., and if the assessment is 80 per cent his bills are based on a 6.0 kw. demand and he pays for 150 kw.-hr. at 10 cents before he gets to the 2½-cent block.

His four motors are a 5 hp., a 3 hp. and two 1 hp., and after looking them over we suspect that they are not fully loaded. A check-up shows this to be correct and that what is really needed is a 3 hp., two 1 hp. and a ½ hp. If these changes are made he has a total load of but 5½ hp. and his assessed demand has been reduced to 3.3 kw., saving him $6.19 per month. His current consumption will also be reduced somewhat, with a further saving in his bill, because the motor losses will have been reduced. This may sound like an extreme case, but I have seen many which were just that bad.

Oversize motors mean idle investment, too

And here is another thing that has nothing to do with his electric bill. He has a lot of money, probably more than $100, uselessly tied up in idle motor capacity. Fortunately these conditions can be corrected for the cost of the ½-hp. motor, for he can replace the 5 hp. with the 3 hp., the 3 hp. with a 1 hp. and he may be able to trade the 5 hp. that he no longer needs for the ½ hp. that he does.

We might have found, however, that he did need those motors, so that the changes could not be made, but we are not yet stumped in trying to help. Perhaps the machines which are driven by the two larger motors do not need to operate at the same time and can be put on a double-throw switch so they cannot both be operated at the same time. The smaller one is then omitted from the computation of the demand, which reduces it by 1.8 kw. and the bill by $3.38.

Most such rates also have a provision that, for a relatively small meter charge, the customer may have his demand metered instead of assessed, and in many cases this is a better solution than the double-throw switch. Those two motors might be driving punch presses or shears which operate continuously. The power stroke, however, lasts for but one to five seconds and the motor idles for five to twenty seconds while the work is being changed. The measured demand for these two motors will then be about 2.0 kw. instead of 4.8 kw. assessed and the customer saves $5.25 less the meter charge.

Those illustrations may have seemed appropriate to a discussion with a high school student, but the method of study and the solutions are the same for any plant. The basis for nine out of ten cases of misunderstood bills lies largely in the customer's having become confused by the electrical terms, and if he can be got to forget about them and approach the problem on a common-sense overhead-and-operating-cost basis the problem becomes just about that simple.

One that I have recently studied had 200 hp. in motors where only 120 hp. was necessary—80 useless hp. of expensive motors running up the overhead, consuming useless power themselves and increasing power bills by creating a poor power factor and causing excessive line losses throughout the plant. Nearly $1,000 per year in excess power costs alone through substituting guesswork for headwork when the motors were bought.

With most larger customers the rate calls for measurement of the demand instead of an assessment, and while this eliminates some of the bad features of oversized motors it generally introduces others. The energy requirements of a motor depend on two things—the requirements of the load itself and the motor losses. The application of a 10-hp. motor to a 5-hp. load does not, therefore, affect the registered demand to the same extent that it would affect an assessed demand, the only difference in demand being the difference between the losses of the two motors.

Oversize motors also power factor offenders

But where the rate includes a power-factor adjustment clause the effect of this oversize motor is again felt. A 5-hp. motor at full load has an efficiency of about 85 per cent, giving an input of 4.3 kw., and it has a power factor of about 85 per cent. If the rate requires 90 per cent power factor the billing demand is increased in the ratio of 90 to 85, or to 4.6 kw. A 10-hp. motor has an efficiency of 87 per cent at half load, so its input is also 4.3 kw., but it has a power factor of only 68 per cent and the billing demand becomes 5.7 kw. instead of the 4.6 kw. for the 5-hp. motor on the same load. Carry this out in a plant with a total of 100 to 500 hp. in motors and look at the results!

And every such misfit motor means useless investment in motors, larger wires to supply them, excessive losses in those wires, an increased power bill and, if the wire size is not correct, poor voltage and motor operation.

Anything that reduces the power bill for an industrial consumer cuts the unit costs of power in that factory and makes a more satisfied customer. Mr. Cole describes how his company helps find economies by running down unnecessary demands, low power factor and waste of kilowatt-hours in idling machines, to make more dollars available for profitable use. Often this opens the way for further uses of power, heat or light. The industrial plant engineer will find many suggestions here—ways to make his dollars spent for electricity go farther and accomplish more.

While we are clearing up some of these mysteries let's see if we cannot take some of the mystery out of power factor—generally the biggest one in connection with a power company's rate. A motor is, in one sense, nothing more than a big magnet and it takes current to magnetize it. If you have too big a motor for the job the actual power may not be any greater than would be taken by the right size motor, but the magnet is too big

and consequently is taking too much magnetizing current. This magnetizing current does not register on the ordinary watt-hour or demand meter, but it is, nevertheless, very real, and the size of the generator, power lines, transformers, switches and all other electrical equipment must be increased to take it. Power factor is the ratio between the useful current and the total current, which is the combination of this registering useful current and the non-registering magnetizing current; 50 per cent power factor simply means that the useful current is one-half the total current and all the supply lines must be twice as large as they ought to be.

Three ways of keeping power factor up

There are three ways in which power factor can be improved and corrected. The first of these is, naturally, to study each of the motors in the plant and reduce the sizes of motors wherever the load conditions permit. In the case previously cited, where there were 200 hp. installed when 120 hp. would have been sufficient, this rearrangement would have resulted in an increase of 20 per cent in the power factor of that load.

Very small motors have an inherently poor power factor and where there are a number of them in an installation it may be impossible to get the power factor up to the required figure by remotoring. It may also be that the average power factor of larger motors may be poor due to load conditions, as where a 10-hp. motor may be necessary to carry the peak of an operating cycle which averages only 5 hp. In such cases it becomes necessary to resort to the second method of correction, namely, the installation of condensers.

They are merely appliances which counteract this excess magnetizing current and thereby improve the power factor to any desired point. They may be installed in a group at the service point, in which case they achieve the result as far as power bills are concerned, or they may be installed in units at the various motors. In the latter case they not only have the same effect on the billing power factor but may result in a considerable saving inside the plant. The removal of this excess current from the plant distribution lines reduces the losses, a direct saving on the bill, and also improves the voltage to the motors, which may result in a considerable saving to the plant. I know of one hosiery mill where this improvement in voltage and motor operation paid for the cost of the condensers in two months by reducing the breakage of threads and the number of the "seconds" which this breakage created.

The third method of correction is by using a synchronous motor, where there is a possible application, which, when operated at a leading power factor, will counteract some of the magnetizing current of the induction motors. Such motors are generally available only in sizes of 50 hp. or more. These applications are therefore possible only where a load of this size exists.

The measurements of the demand offers an opportunity to the wideawake operator to exercise a considerable control over the size of his electric bills, as a little care and thought in scheduling production and the operation of the various departments may pay sizable dividends in reduced bills. Where the operation of two motors is intermittent or where two departments operate but half a day apiece it is frequently possible to regulate their operation so they do not both operate at the same time. This can be accomplished by personal supervision or by automatic control.

There are several instruments on the market which will give an alarm when the demand reaches a predetermined limit so that a non-essential process or motor can be temporarily shut down. Frequently this demand limiter is hooked up to shut it down automatically where such a thing is feasible. A pump on a tank with fairly large storage capacity lends itself admirably to such an arrangement, as does an air compressor with a large accumulator or other heavy machines which are operated only part of the time. One paper mill with which the writer is familiar has enough stock storage capacity that he can shut down one or two of his beaters for a few minutes and save 40 to 50 kw. on his demand.

There are, however, numerous opportunities for economy which can influence a bill to as great an extent as can economies in the demand charge. Idling machines consume current and there is undoubtedly much room for a reduction in this item in any plant. Unnecessary idling of any piece of machinery is poor policy—entirely aside from the power bill angle—so there is a normal tendency for supervisors to keep this item under control. However, while I have seldom seen a plant where there is not room for improvement by stopping machines between operations, it must be borne in mind that where this interval is relatively short it is better to let it idle than to stop and start it too frequently.

Eliminate inefficient equipment and shaft losses

A thorough study of motor loadings in connection with the demand or power factor will also disclose two conditions which may be causing excessive current consumption. These are old, inefficient motors or machines and excessive line shaft losses where group drive is utilized. The former of these is too obvious to warrant discussion in this article and the latter is becoming more and more rare as the modern trend is definitely toward individual drive. There are many cases where group drive offers distinct advantages, but in general the relatively high losses, particularly when it may be necessary to operate only a few of the units for an appreciable length of time, together with the increased flexibility of operation and improvement in lighting and general appearance which individual drive affords, are responsible for a steady decrease in the number of group drives.

The writer, with a number of years of experience behind him, believes that by far the larger proportion of high power bill complaints are due to the fact that the average power customer is convinced that no one who is not a trained engineer who understands all the electrical terms can make heads or tails out of an electric bill.

Divested of its technical terms, a power bill becomes an elementary study of the economies of overhead and operating costs with the advantage to the customer who is interested that each bill shows their relation to the total, whereas in the ordinary bill the vendor has averaged them himself and the purchaser has little opportunity to study them. If the realization of these facts can be brought home to the average customer and he can be got to approach his power bill with this background he will find their aura of mystery largely dissolved and, with the application of a little thought and common sense, he will find them surprisingly susceptible to control.

LETTERS TO THE EDITOR

Light Flicker Will Yield to Study

To the Editor of the ELECTRICAL WORLD:

I have read with great interest the article on the subject "Auto-Transformers Reduce Light-Flicker Complaints," in the March 24 issue of ELECTRICAL WORLD. It bears out the fact that with proper study the utility engineers can contribute largely to the solution of the problem of light flicker caused by the starting of motors and to the correction of other irregularities caused by connected motor loads. This was pointed out in my article, "Plan Now for Desirable Air-Conditioning Load," published in ELECTRICAL WORLD, March 17, 1934, and also in a discussion on page 610 of the April issue of *Electrical Engineering* on various papers relating to distribution.

I can only repeat that a great deal of attention to this problem by the interested engineers is desirable and that the solution suggested by Messrs. Jaquith and Fiedler seems to offer at least one excellent way of handling the problem.

R. E. HELLMUND,
Chief Engineer.
Westinghouse Electric & Manufacturing Company.
East Pittsburgh, Pa.

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Comparative Cost of Coal

To the Editor of the ELECTRICAL WORLD:

The following paragraph from the editorial page of ELECTRICAL WORLD, April 14 issue, has been brought to my attention:

> Now operating costs are going up. Fuel oil that was 60 cents is now $1.20; coal that was 85 cents at the mine is $1.65 a ton. Other supplies have risen likewise. The average is probably 50 per cent, and that makes a deal of difference in the cost of running a private plant.

The inference drawn from this comparison of fuel prices is that the "private plant" must now pay practically twice as much for either fuel oil or coal as it formerly paid.

No criticism is made of the price range indicated for these two fuels. At the time the editorial was written the figures were probably correct for certain sections of the country. However, the figures for fuel oil represent the price of oil *delivered* at the Atlantic seaboard, while the coal prices, as stated in the editorial, are *at the mine.*

The average freight rate paid on bituminous coal to the Atlantic seaboard is probably around $2.50 a net ton. If this amount is added to the cost of coal at the mine the delivered prices for coal will be $3.35 and $4.15 (based respectively on costs at the mine of 85 cents and $1.65). These *delivered* costs for coal are now comparable with the *delivered* costs for fuel oil—both at Atlantic tidewater. The increase from 60 cents to $1.20 in the cost of fuel oil *delivered* represents an increase of 100 per cent. The increase from $3.35 to $4.15 in the cost of coal *delivered* represents an increase of 24 per cent.

Thus, the percentage of increase in the cost of coal delivered to the Atlantic seaboard is less than one-fourth the percentage of increase in the cost of oil delivered to the Atlantic seaboard (assuming that the price ranges upon which the editorial was based are correct). These corrected percentages reflect the greater stability of coal prices and the lower rate of price fluctuation for coal as compared with fuel oil.

Furthermore, if the average price increase for other supplies is "probably 50 per cent," as assumed in the editorial, the delivered cost of coal has increased less than one-half of the average increase for other materials. Whether fuel costs are increased 100 per cent, as for fuel oil, or only 24 per cent, as for coal, certainly does make "a deal of difference in the cost of running a private plant," as is pointed out in the original editorial.

CARL STRIPE,
Assistant to Vice-President.
Davis Coal & Coke Company,
Baltimore, Md.

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Corrections Desirable in Metering Article

To the Editor of the ELECTRICAL WORLD:

On rechecking the tables in the lower part of the figures. that accompanied our article "Connection Check by Lamp for Polyphase Meters" in your May 5, 1934 edition, we noticed the following inadvertent errors that should be corrected:

Fig. 1, right diagram (incorrect connection) Step 5, lower element—"Rotation" should be "None," same as for middle and upper elements.

Fig. 2, right diagram (incorrect connection) Step 3, upper element—"Connections," 2_M-10_M and 2_M-6_M should be reversed; that is 240 volts for 2_M-6_M and O volts for 2_M-10_M. Steps 5 and 6, upper element—"Rotation" should be "Forward" as connections for upper element are correct.

M. MINIKES and A. F. NEWMAN.
New York & Queens Electric Light & Power Company,
Flushing, N. Y.

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Range Wiring and the Code

To the Editor of the ELECTRICAL WORLD:

V. C. Moulton's letter in the ELECTRICAL WORLD, April 28, 1934, page 629, indicates that the method of grounding the range frame shown in the article "Range Wiring Costs Cut to $17," page 518, ELECTRICAL WORLD, April 7, 1934, violates the grounding requirements of the National Electrical Code. This is not exactly the whole story.

It is true that the last sentence of Section 908 (f), page 138, does distinctly prohibit the use of the grounded circuit conductor as the grounding medium for raceways, equipment and the like. However, if we also refer to Section 908 (i) (4), page 139, which reads, "By permission of the authority enforcing this code other means for grounding fixed equipment may be used," we find that this form of grounding equipment may be used if agreeable to the inspection authority having jurisdiction.

It is my understanding that this latter paragraph (908-i-4) was added at the last electrical committee meeting to permit this method of grounding range frames if acceptable to the local inspection authority. Apparently the electrical committee was not willing to recognize this method of grounding equipment on all types of grounded circuits at the present time, but has left the way open for local inspection bureaus to approve it in the territories under their jurisdiction.

Therefore, this method of grounding equipment cannot be classed as a code violation if it is acceptable to the local inspection bureau, as noted above.

W. WEINERTH.
Philadelphia, Pa.

BOOK REVIEWS

National Electrical Code Handbook

By Arthur L. Abbott. Published by the McGraw-Hill Book Company, Inc., 330 West 42d Street, New York, N. Y. Second edition, 523 pages, illustrated.

A revised edition to interpret the plan, scope and details of the 1933 National Electrical Code. The code is not repeated in the handbook, which, however, explains most of its sections, in many cases with diagram.

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Calculation and Design of Electrical Apparatus

By W. Wilson. Published by Isaac Pitman & Sons, 2 West 45th Street, New York, N. Y. 214 pages, illustrated. Price, $3.

Building on his experience as examiner of the (British) Institution of Electrical Engineers for candidates in the design category the author has detailed the solution of a large number of design problems, not in machinery windings, but in the apparatus realm. Subjects include fusing currents in conductors, I^2R heat transfers with time element injected, forces in busbars and transformer windings and switches, resistance proportioning for starters, system faults, magnet coils and cores, heavy conductor phenomena, line characteristics, etc. Fundamentals and vectors and symmetrical components take three chapters. Much tabular design data is interspersed throughout the book; mathematical tables fall in an appendix.

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America Self-Contained

By Samuel Crowther. Published by Doubleday, Doran & Company, Inc., 244 Madison Avenue, New York, N. Y. 340 pages.

A very interesting thesis is developed whereby America is to be self-contained and stand alone. The elements of the discussion are based upon our resources and standard of living in comparison to the other parts of the world. Many will disagree with the diagnosis and the remedies, but the book is very stimulating and interesting.

NEWS OF THE WEEK

Housing Program Bill Introduced

Roosevelt message asks four-point program, including home modernization. $300,000,000 capital required. Senate votes for $530,000,000 loans to industry.

The Administration's home renovation and construction program, after two months of half-hearted preliminaries, began its legislative journey this week. The program offers wide opportunities to the electrical industry. President Roosevelt, in a message to Congress, urged a four-point program, providing for the following:

1. Federal long-term loans at low interest rates, up to a maximum of $2,000, for the modernization or improvement of all types of property, but with primary emphasis on homes.

2. Federal guarantee of new mortgages on existing homes up to 60 per cent of "currently appraised value," and guarantee of mortgages on newly completed homes up to 80 per cent of appraised value.

3. The private organization, under federal supervision, of mortgage associations to provide low-cost, long-term financing for home owners or builders under such safeguards as to make the mortgages attractive investments.

4. Insurance of shares and certificates of sound building and loan associations.

$300,000,000 financing asked

The reading of the President's message was immediately followed by introduction in both houses of identical bills carrying out the plan. The legislation would establish a Home Credit Insurance Corporation to administer the act. It would have an authorized capital not to exceed $200,000,000, to be supplied by the Treasury. The corporation would work in close harmony with the Home Owners' Loan Corporation.

Senate passes industry loans bill

The Senate this week adopted the Glass-Barkley bill providing approximately $530,000,000 in direct loans to business enterprises to tide them over the present credit crisis. They would be on adequate security and only to solvent concerns which could not obtain credit in regular channels.

An amendment to the bill offered by Senator Johnson of California would have authorized loans for purchase of privately owned power plants by municipalities. The proposal was rejected.

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Shawinigan Completes Rapide Blanc Hydro

The Shawinigan Water & Power Company put into operation last week its new 160,000-hp. hydro-electric plant at Rapide Blanc on the St. Maurice River, upper Quebec. This is the first of a series of hydro developments on the river designed to yield eventually about 1,000,000 hp. The project, begun in 1930, was completed more than a year ahead of the original schedule according to the company.

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Thayer Investigation Ends; Senate Decision Awaited

Investigation by the New York Senate judiciary committee into the relations of Senator Warren T. Thayer with the Associated Gas & Electric Company, when he was chairman of the Senate committee on public service, ended early this week. United States District Judge John Knight, who appointed Senator Thayer to this position successively in 1925, 1927, 1929 and 1931, in his capacity as temporary president of the Senate at that time, testified that when he made these appointments he did not know most of the facts that have been developed since the investigation began. Employees and officials of the Associated company and some of its subsidiaries also were called to the stand.

Senator Thayer testified, as his last word on the stand, that his attitude on public utility bills while chairman of the public service committee had not been influenced in any way by his "employment to perform certain services for these companies in the northern part of the state." Senator Thayer was the recipient of payments aggregating $21,600 from the Assbciated during the six years he was chairman of the committee. This remuneration was supposed to have compensated him for loss of salary as vice-president and general manager of the Chasm Power Company after he had been instrumental in selling that company to the Associated. The case will now go to the full Senate for a final decision on whether Senator Thayer is to retain his seat or be expelled on implied charges of official misconduct.

Survey Reveals Appliance Markets

Preliminary report of Commerce Department shows extent of heavy appliance use in 26 communities. Suggestions asked from the industry for final draft to be completed in July.

OPPORTUNITIES for further development of range and refrigerator sales are revealed in the preliminary report of the electrical equipment division of the Department of Commerce. This is based on the department's real property survey.

Covering 26 cities, the electrical equipment division's preliminary investigation shows that heavy appliance manufacturers may expect a good business with the return of consumer-purchasing power. The complete study of the division, expected about the middle of July, will cover all the 63 cities reported in the real property survey of the department.

Cities	Total Dwelling Units	Per Cent Using Electricity for Lighting	Per Cent Using Electricity for Cooking	Per Cent Having Mechanical Refrigeration*
New England				
Nashua, N. H.	7,969	95.3	0.3	14.5
Burlington, Vt.	6,518	97.6	3.2	16.1
E. No. Central				
Decatur, Ill.	16,407	92.4	0.2	14.2
W. No. Central				
Springfield, Mo.	16,200	85.7	0.7	17.2
Fargo, N. D.	7,467	97.5	0.2	25.8
Sioux Falls, S. D.	9,240	97.5	1.8	18.4
Lincoln, Neb.	23,242	97	0.4	27.6
South Atlantic				
Frederick, Md.	3,785	87.8	4.5	20.1
Hagerstown, Md.	8,149	94.5	3.2	19.5
Asheville, N. C.	12,584	80.5	6.5	15.9
Greensboro, N. C.	12,061	82.7	2.1	18.3
Charlestown, S. C.	17,911	49.8	10.2	9.1
Columbia, S. C.	12,188	64.6	0.2	15.5
E. So. Central				
Paducah, Ky.	9,029	68.3	0.2	6.4
W. So. Central				
Little Rock, Ark.	27,792	72.3	0.1	16.7
Baton Rouge, La.	7,692	70	0.2	13
Shreveport, La.	21,872	71.7	8.2	10.1
Wichita Falls, Tex.	10,722	83.6	0.6	13.2
Mountain				
Butte, Mont.	10,627	99.1	10.3	9.3
Boise, Idaho	6,477	96.7	29.6	20.1
Casper, Wyo.	5,619	90.9	0.5	14.4
Pueblo, Col.	12,723	90.7	11.5	12.5
Albuquerque, N. Mex.	7,820	87.7	0.9	14.4
Phoenix, Ariz.	14,392	91.6	0.7	20.2
Reno, Nev.	6,194	96.1	21.5	22
Santa Fe, N. Mex.	2,720	74.7	2.8	10.8

*Mechanical refrigeration on this table also includes gas refrigeration.

Little Rock leads

Some interesting figures may be gleaned from the accompanying table. The largest community studied, Little Rock, Ark., has a population of 27,792, yet it stands near the last in the percentage of homes wired for lighting, namely, 72.3 per cent. The same city has the lowest figure for electric cooking at one-tenth of 1 per cent of the total homes, yet its refrigeration saturation is relatively high, with a percentage of 16.7.

The highest lighting saturation appears in Butte, Mont., 99.1 per cent, the lowest in Columbia, S. C., 64.6 per cent. The report shows more

than one out of every five homes in Reno, Nev., cooks by electricity and nearly every third home has an electric range in Boise, Idaho. Lincoln, Neb., and Fargo, N. D., show greatest refrigeration saturation, with percentage of homes equipped standing at 27.6 per cent and 25.8 per cent, respectively. The least saturated market for refrigerators is Paducah, Ky., with a percentage of 6.4.

The survey, when completed, will show for each city the number of dwelling units, the number using electricity for lighting, cooking and mechanical refrigeration, as well as energy rates. Suggestions are invited from the industry for any other statistics that might be included in the report for their help. Communications should be addressed to Andrew W. Cruse, chief of the electrical equipment division, Department of Commerce, Washington, D. C.

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E.E.I. to Encourage Rural Pump Sales

Forms joint committee with house pump equipment manufacturers to conduct promotion campaign. Will co-ordinate sales of dealers and power companies.

Pump manufacturers are launching a sales campaign in co-operation with the Edison Electric Institute to develop the market for domestic and farm water pumping. The rural sales committee of the institute initiated the movement. It will follow along lines similar to the recent lighting, table cookery and refrigeration programs, and capitalize the need for running water in many thousands of rural and semi-rural homes.

The representatives of the Edison Electric Institute were P. H. Powers, chairman; E. A. White, F. A. Belden and C. E. Greenwood. They got in touch with the National Association of Domestic and Farm Pumping Equipment and Allied Product Manufacturers and a special committee was appointed by the manufacturers consisting of C. W. Coapman, Delco Appliance Corporation; W. H. Wallbaum, Fairbanks Morse Company; J. C. Myers, F. E. Myers & Brother Company; N. J. Gould, Gould Pump, Inc.; H. C. Angster, National Association Domestic and Farm Pumping Equipment and Allied Products Manufacturers, and A. E. Hazeltine, Red Jacket Manufacturing Company. Mr. Coapman has been appointed chairman of the joint committee.

A co-operative promotion program is under development which will extend over fifteen months, beginning on August 1, but concentrating the selling in short periods from August 1 to October 1, 1934; February 1 to April 1, 1935, and August 1 to October 31, 1935. The committee plans to set up a small fund to support the national work and this will be devoted largely to co-ordinating the local campaigns which will follow the national program. A slogan has been adopted—"Running Water—Every Home Deserves It." The council hopes to double the rate of sale of electric water systems and establish a closer relationship between the power companies and the plumbers, implement dealers and hardware stores that sell electric pumping equipment.

This campaign will therefore attempt to organize an entirely different class of distribution than has been involved in previous electrical campaigns. Local bureaus will be set up in communities where the manufacturers are adequately represented, in an effort to co-ordinate the pumping, equipment and wiring services which are all part of an installation. The local utilities will be asked to develop prospect lists and help the dealers in financing and in securing the service to these rural homes.

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Potomac Power Co. Quits Appliance Merchandising

Voluntarily abandoning its appliance sales subsidiary, the Potomac Electric Power Company of Washington, D. C., has organized an Electric Institute, in co-operation with manufacturers, jobbers, dealers and retailers. The institute will replace the Potomac Electric Appliance Company and the merchandise formerly retailed by that company will be sold by district merchants.

A continual display of appliances will be maintained in showrooms in the power company's office building. The action of the utility was taken after an extensive survey of marketing conditions in the city, made by J. S. Bartlett, formerly of the Society for Electrical Development, New York City, and now managing director of the institute. As part of the co-operative program the utility is furnishing free wiring in the installation of electric cooking appliances.

Defensive Advertising Urged for Utilities

Federation of Utility Investors chairman proposes campaign to correct public misinformation. Sees danger to securities.

A nation-wide advertising campaign in their own defense was urged on public utilities last week by Chester D. Tripp, chairman of the executive committee of American Federation of Utility Investors, Inc. In a letter to all of the utility companies of the United States Mr. Tripp asked for "immediate action by the companies in order to correct the widespread public misinformation which is a definite danger to the future of the securities owned by the ten million investors of the country."

The proposed advertising would take the form of campaigns by individual companies in local newspapers in their respective territories and would appeal to the "innate sense of fairness and justice of the public."

"A great deal of the blame for the public's lack of understanding rests squarely on the shoulders of utility managements, who have neglected to develop their public relations," the letter stated. "During the early days of utility development, mechanical and scientific minds were of the greatest importance. The next step required able financial management capable of enlarging and consolidating the rapidly growing company structure. The industry has now come to the point where public relations are of the greatest importance and the successful management must handle its public in the spirit of mutual confidence and understanding."

SOVIET HYDRO WITHIN THE ARCTIC CIRCLE

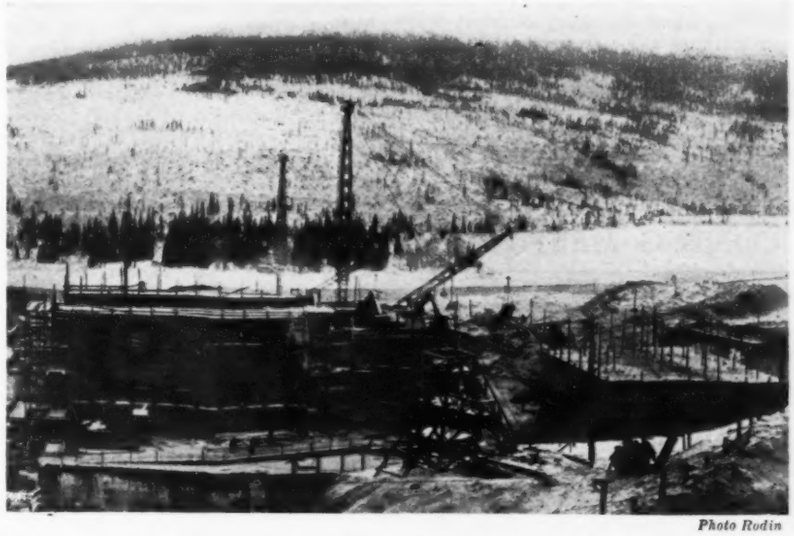

Photo Rodin

THIS photograph was taken in March at the Nivastroi hydro-electric station. It is the northernmost plant in Eurasia, lying well within the Arctic Circle. The first section of the plant will be completed next month with installation of a 20,800-hp. turbine. Two more turbines will be added by the end of the year and the station will reach its planned capacity with the addition of a fourth turbine. The station will be able to deliver its 92,000 kw. capacity the year round, as the swift-flowing Niva River remains open all winter. Its power will be used for the operation of apatite mines.

E. E. I. Convention Program Completed

Atlantic City meeting to be an industry conference allowing individual expression and discussion. Four general sessions scheduled. Topics bear on operating sales problems, costs and holding companies.

Program details for the second annual convention of the Edison Electric Institute, to be held at Atlantic City, N. J., June 4 to 7, have been completed. The convention this year has been organized as an industry conference to secure greater opportunity for individual expression during business sessions and a wider opportunity for informal meetings and discussions.

The subjects for discussion at the general sessions have been selected because of their vital bearing on present-day operation of the electric light and power industry. They include practical engineering changes which reduce costs, the status of the holding company, the adjustment of operations to present trends and commodity prices, the allocation of costs of service in the electric industry, sales subjects of pressing importance and trade relations.

Four general sessions scheduled

Four general sessions will be held during the convention. In addition a number of institute committees have called meetings to be held during the period. General sessions will be held on the mornings of June 5, 6, 7 and on the evening of June 6. Headquarters will be at the Traymore Hotel, where all meetings will be held. Reduced railroad rates will be available to those attending the convention. Social activities have been arranged for the ladies attending the meeting. The session program is as follows:

Tuesday, June 5, 10 A. M.—President George B. Cortelyou will deliver the opening address. Edward Reynolds, Jr., institute treasurer, and Bernard F. Weadock, vice-president and managing director, will discuss institute affairs which come within their special jurisdiction.

Hudson W. Reed, management engineer United Gas Improvement Company, will present a "Plan for Determining Costs of Service in the Electrical Industry." Discussion of the plan will be made by Arthur H. Kehoe, vice-president New York Edison Company; Mark Eldredge, chief engineer Memphis Power & Light Company, and Norman R. Gibson, vice-president Niagara Hudson Power Corporation.

Business of getting business

Wednesday, June 6, 10 A. M.—Sales and merchandising problems will feature the second general session. George E. Whitwell, chairman of the sales committee of the institute and vice-president of the Philadelphia Electric Company, will speak on "The Business of Getting Business." Allen L. Billingsley, president Fuller & Smith & Ross, Inc., will discuss "Economics of an Electrical Home." T. K. Quinn, vice-president General Electric Company, will present the facts and offer practical solutions on "Facing Competition."

James E. Davidson, president of the Nebraska Power Company, will discuss "Dealer Co-ordination as Aid in Load Building." Concluding the session will be a novel demonstration of "Light and Vision—the New Partnership," a presentation of the Better Light—Better Sight Committee, M. E. Skinner, Niagara Hudson Power Corporation, chairman.

Wednesday, June 6, 8:40 P. M.—Addresses at this session will be made by Floyd L. Carlisle, member of the E. E. I. board of trustees and chairman of the board of Niagara Hudson Corporation and Consolidated Gas Company of New York, and Bernard F. Weadock of the Institute. Mr. Weadock's address will be a discussion of holding companies.

The industry's engineering problems

Thursday, June 7, 10 A. M.—The session will open with a paper "Progressive Engineering Pays Its Way," by Philip Sporn, vice-president American Gas & Electric Company. Discussion of Mr. Sporn's paper will follow its presentation. J. L. Hecht, Public Service Company of Northern Illinois, will have as his subject "Adjusting Operations to Present Trends." F. A. Newton, Commonwealth & Southern Corporation, will present a discussion on "Commodity Prices" and their relation to costs of production of electricity.

At this session Frank W. Smith, president of the New York Edison Company and chairman of the prize awards committee, will announce the winners of the several prize awards administered by the institute. These include the Charles A. Coffin award, H. M. Byllesby prizes, Forbes prize, A. L. Lindemann prizes, James H. McGraw prizes, Thomas W. Martin award and the George A. Hughes Award. On this occasion, also, the first presentations of the new Edison Electric Institute medal for resuscitation by the prone-pressure method will be made.

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Foshay Enters Prison

Wilbur B. Foshay and Henry H. Henley, former president and vice-president of the defunct Foshay group of Minnesota utilities, entered Leavenworth prison last week to begin terms of fifteen years each. Their bid for executive clemency had been refused. Both men were convicted of using the mails to defraud in selling the stocks of their companies.

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To Resume Power Show

The eleventh National Exposition of Power and Mechanical Engineering will be held at the Grand Central Palace, New York, December 3-8, inclusive. The Exposition resumes after a lapse of a year, and follows its former custom of meeting during the same week that the American Society of Mechanical Engineers holds its annual meeting in New York. Power generation and distribution, engines and auxiliaries, electrical equipment and elevators, boilers, pumps, air compressors and refrigeration equipment exhibits will be featured, to show the most valuable and the newest improvements.

COMING MEETINGS

National Electrical Manufacturers Association—The Homestead, Hot Springs, Va., May 21-24. W. J. Donald, 155 East 44th St., New York.

Edison Electric Institute—Atlantic City, N. J., June 4-7. B. F. Weadock, 429 Lexington Ave., New York.

Canadian Electrical Association—Annual convention, Seigniory Club, P.Q. (Lucerne-in-Quebec), June 13-15. B. C. Fairchild, 409 Power Building, Montreal, Que.

Public Utilities Advertising Association—Annual convention, New York City, June 17-20. Eric W. Swift, Commonwealth Edison Company, Chicago, Ill.

American Society of Mechanical Engineers—Semi-annual meeting, Denver, Col., June 25-28. Calvin W. Rice, 29 W. 39th St., New York.

American Institute of Electrical Engineers — Summer convention, Hot Springs, Va., June 25-29. H. H. Henline, 33 W. 39th St., New York.

——THIS WEEK IN WASHINGTON

Senate vote close on proposal to free R.F.C. funds for municipal purchase of competing utilities . . . President signs Johnson rate litigation bill . . . Feelers for the rate census.

BY THE margin of a single vote the Senate rejected an amendment to the loans to industry bill by Senator Johnson of California which would have authorized the Reconstruction Finance Corporation to make 20-year loans to public agencies for the acquisition of competing electrical systems. Originally the proposal applied only to Los Angeles, but to meet objections the plan was broadened so as to include all public agencies purchasing electrical energy from the government. Senator Johnson said the legislation is justified in that it would correct an uneconomical and troublesome situation in Los Angeles, where the publicly owned system competes directly with a privately owned power company. Senator Glass of Virginia led the fight against the proposal, which he characterized as "appalling." "Heaven only knows in what it would result," exclaimed the Virginia Senator.

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The bill requiring utilities to litigate their rate cases in state courts was signed by President Roosevelt on May 14 and is now the law of the land.

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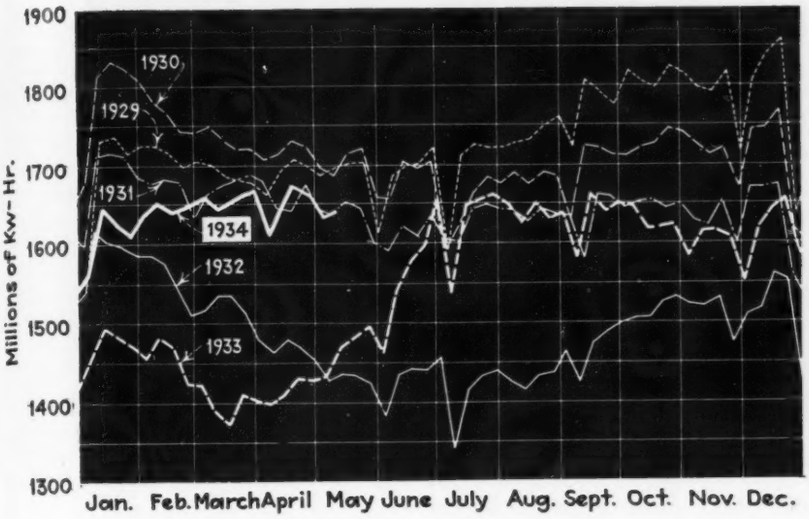
Before the general questionnaire is sent out in connection with the census of electrical rates, the Federal Power Commission is preparing drafts to be sent out experimentally. These experimental questionnaires will go to certain localities where the situation is known to be complex and where power companies have agreed to co-operate in the effort to develop the most effective form of questionnaire.

PAUL WOOTON
Washington Correspondent.

Output Near 1930 Level



Central station energy output during the week ended May 12 increased moderately over the preceding week. It amounted to 1,643,433,000 kw.-hr., according to the Edison Electric Institute. The rise was contrary to the usual trend, which at this season is still downward; viewed in connection with the decreasing demand for lighting, it indicates some further expansion in the use of energy for manufacturing, although detailed data are not yet available.

A year ago there was an unprecedented upward surge in the production curve. Nevertheless, present production still shows a margin of nearly 12 per cent over 1933, against 13.7 per cent in the preceding week, and the gain over 1932 has risen to 14.4 per cent. Operations continue to be fully up to the 1931 level and are now only 2.7 per cent under the same week in 1930. High percentages over 1933 are reported for the Mountain, Pacific and Central industrial areas.

Weekly Output, Millions of Kw.-Hr.

1934	1933	1932
May 12....1,643	May 13...1,468	May 14...1,437
May 5....1,633	May 6...1,436	May 7...1,429
Apr. 28....1,669	Apr. 29...1,428	Apr. 30...1,455
Apr. 21....1,673	Apr. 22...1,431	Apr. 23...1,470
Apr. 14....1,642	Apr. 15...1,410	Apr. 16...1,481

Per Cent Change from Previous Year

Region	Week ended May 12	May 5	Apr. 28
New England.....	+ 9.1	+13.0	+16.7
Middle Atlantic....	+ 7.7	+10.2	+12.3
Central Industrial..	+15.5	+16.3	+22.6
West Central.....	+ 8.7	+ 6.5	+10.6
Southern States....	+ 7.6	+11.5	+17.2
Rocky Mountain...	+25.5	+26.8	+25.2
Pacific Coast.....	+16.0	+15.3	+12.5
United States.....	+11.9	+13.7	+16.8

German 300-ton Cranes for Russian Steelworks

Two overhead 300-ton traveling cranes were recently supplied to a steel works in the U.S.S.R. by Maschinenfabrik Augsburg-Nürnberg A.-G. of Nürnberg, Bavaria. Each crane has a span of 98.6 ft. and lifting height of 92 ft. Main girders are moved by two 174-hp. traveling motors at speeds up to 131 ft. per minute. The two crabs per crane are a main 300-ton crab and a 100-ton auxiliary crab. Main crabs are equipped with two 174-hp. lifting motors which support an eight-sheave pulley block and give lifting speeds from 6.6 to 8 ft. per minute. They are fitted with a 99-hp. motor which gives a traversing speed of 98 ft. per minute. Auxiliary crabs are fitted with 25-hp. motors which give the same traveling speed and have four-sheave lifting blocks supported by two drums driven by one 174-hp. motor for maximum lifting speeds of 14 ft. 9 in. per minute.

The cranes jointly serve a 15,000-ton hydraulic forging press. Operation can be controlled from the ground through trolley wire connections or from control stations at working level suspended from the cranes by lattice frames. Each crane weighs 500 tons without blocks and suspended winch.

Geological Survey Shows Output Rise

Increase of 2.7% over 1932. Central stations produced 93.7% of total. Drop in aggregate generating capacity noted.

Electric utility plants generated more energy in 1933 than in 1932. The increase amounted to 2.7 per cent and brought the total close to 85,402,000,000 kw.-hr. This includes central stations, plants operated by electric railways and railroads, the Bureau of Reclamation and public works, and that part of the production of electricity by manufacturing plants which is sold. A final report just issued by the U. S. Geological Survey gives detailed information on the year's operations. The accompanying tables are abstracted from that report.

Central stations for electric light and power, including municipal, contributed by far the larger part, nearly 80,000,000,000 kw.-hr., or 93.7 per cent of the whole. Production from water power was greater than in any other year, 34,727,000,000, kw-hr., or 40.7 per cent of the entire public utility plant output. The previous maximum of 34,696,000,000 kw.-hr. was attained in 1928.

Aggregate generating capacity declines

There was a slight decrease in aggregate generating capacity, now amounting to 36,038,465 kw., revealed by a comparison of the statistics for 1933 with those for 1932. Such a thing has never before occurred in the history of the power industry. Viewed in connection with the decrease of 59 in the number of plants, it indicates that small and obsolete equipment is definitely being eliminated. Just where these changes were made can be ascertained by comparing the company figures on plant capacity in the ELECTRICAL WORLD Supplement of May 5 with those published similarly a year ago.

Regionally analyzed, changes in capacity compared with 1932, expressed in per cent, were as follows: New England, + 0.2; Middle Atlantic, + 0.9; East North Central, — 2.6; West North Central, + 1.0; South Atlantic, + 2.0; East South Central, — 2.6; West South Central, + 2.1; Mountain, 0; Pacific + 0.4.

Classes of Public Utility Plants

Number, Capacity, Output

Class of plant	Companies	Plants	Capacity, Kw.	Output, Thous. Kw.-Hr.
Central stations.....	1,433	3,673	33,970,602	79,983,339
Electric railways.....	29	40	1,088,910	2,452,841
Electric railroads.....	6	7	294,560	569,973
Bureau of Reclamation.....	4	11	37,977	167,746
Public works.....	11	14	357,050	1,086,762
Manufacturing.....	54	60	289,366	1,141,071
Totals.....	1,537*	3,805	36,038,465	85,401,732

*Includes 88 duplications due to companies operating in more than one state.

Capacity of Generators

Power Plants Generating Electricity for Public Use, December 31, 1933 (United States Geological Survey)

Geographical Region	Companies	Plants	Total capacity, Kw.	Capacity of Plants operated by Water Power, Kw.	Steam Power, Kw.	Internal Combustion Engs., Kw.
United States.....	1,537	3,805	36,038,465	9,773,502	25,765,739	499,224
New England.....	143	327	2,947,877	813,492	2,125,630	8,755
Middle Atlantic.....	154	427	9,251,169	1,509,752	7,702,630	38,787
East No. Central.....	298	665	8,021,901	644,905	7,344,597	32,399
West No. Central.....	360	737	2,674,586	479,732	2,027,624	167,230
South Atlantic.....	165	439	4,395,474	1,929,485	2,416,414	49,575
East So. Central.....	79	221	1,673,724	904,921	743,621	25,182
West So Central.....	134	390	1,751,230	92,715	1,537,195	121,320
Mountain.....	127	309	1,190,074	783,345	362,113	44,616
Pacific.....	77	290	4,132,430	2,615,155	1,505,915	11,360

As to Rates . . .

Public Service Company of Indiana hearings on a permanent injunction against the recent rate reduction order of the state Public Utility Commission have been continued. At the request of Attorney-General Philip Lutz, Jr., an indefinite continuance has been granted by Federal Judge Thomas W. Slick. The Attorney-General maintained that the state is not ready to produce evidence in the commission's behalf. A temporary injunction was granted several weeks ago restraining the commission from enforcing its order (ELECTRICAL WORLD, May 5, page 669).

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Marlborough Electric Company has been ordered by the Massachusetts Department of Public Utilities to establish a new schedule of rates for residential consumers. The commission maintains that the return of 7¼ per cent on the capital stock and premium of the company under present circumstances and conditions warrants reduction in the rates. In discussing the purchase of power from the New England Power Company the commission stated: "This company is well situated geographically to purchase from the New England Power Company. The purchase from the New England Power Company is made under an old contract, originally made in 1922, and there has been no change in the price of 14¼ mills per kilowatt-hour since that date. Other companies, not situated as favorably as Marlborough and not purchasing as many kilowatt-hours per year, are charged less by the New England Power Company. The commission feels that the price paid to the New England Power for electricity should be as advantageous as that of other companies not so well situated and the customers of Marlborough should receive the benefit of this saving, small as it may be."

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Public Service Electric & Gas Company's plans to meet increased demand for electricity in future were outlined last week at a hearing before the New Jersey Public Utilities Commission in the inquiry into the electric rates of the company. Marion Penn who is general superintendent of generation of the electric department, testified that power plants at Kearny, Essex, Marion and Burlington would be enlarged and new plants constructed at Edgewater and Sewaren. Interrogated as to the use of oil and coal in generating steam, Mr. Penn declared that in 1932 and 1933 oil was more economical, but that today coal is more economical. He added that many of the boilers in the Public Service plants are so equipped that either coal or oil can be used.

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City to Sell Appliances

Following a favorable opinion by Attorney-General Harry H. Peterson, the Rochester (Minn.) Public Utility Board has decided to retail electric ranges and other appliances. The Attorney-General ruled that the city utility department has a right to make direct sales of appliances to customers. The board plans to sell the ranges through local electric dealers, who will be paid a commission by the city for every unit sold.

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Boston Municipal Plant Fought Before House

After a bitter debate, the Massachusetts legislative committee on municipal finance voted "leave to withdraw" on the petition of former City Councilor Francis Kelley for the establishment of a municipal lighting plant in Boston. F. Manley Ives, counsel for the Boston Edison Company, appeared in opposition to the erection of the municipal plant. "This proposal," Mr. Ives said, "means nothing but duplication of the Edison property in the city of Boston. We have not yet made an inventory to determine the value of the property. One or the other of these enterprises is going to fold up. In the long run it will be the Edison company. It cannot compete with a municipal plant that will pass on the deficits to the taxpayer. . . ."

W. A. Dupee, appearing for the Provident Institution for Savings, stated that the bank would sell its holdings of city of Boston bonds if the bill for establishment of the plant was passed. The Boston Chamber of Commerce was represented by Claude Allen, who said: "There is no actual need for such a venture except to suggest that it might force a cut in the rates for existing service. This suggestion is along the lines of a new philosophy of municipal government which calls for the use of community credit to duplicate an existing service for the purpose of securing rate reductions. The Boston Chamber of Commerce is opposed to such a program on the broad principle that to duplicate any public service is wasteful, unnecessary and serves no useful purpose. . . ."

Following the hearing proponents of the project appealed to Speaker Saltonstall of the House to have the committee reopen hearings. The Speaker has taken the request under advisement.

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Georgia Cities Granted Permanent Rate Injunction

Sixteen Georgia municipalities, operating their own light and power plants, have been granted a permanent injunction restraining the state Public Service Commission from attempting to regulate the rates charged customers. Judge V. B. Moore of Fulton Superior Court ordered that a temporary restraining order against the commission be made permanent.

The city of Albany originally applied for the injunction (ELECTRICAL WORLD, March 10, page 370) and was joined by fifteen other municipalities, which filed interventions after all had received notices from the commission to file their rate schedules for study and readjustment. The commission contended that the Legislature had delegated powers and prescribed its duties to examine and regulate the rates charged by public utilities whether publicly or privately owned. The municipalities held that under the terms of chartered amendments granted them by the Legislature they retained the authority to control rates.

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Court Protects Purchasers of Municipal Warrants

Warrants authorized by a score of Iowa towns for the building of municipal electric light plants must now be submitted to the exacting scrutiny of the state Blue Sky Department before they can be offered for public sale to Iowa investors. The Iowa Securities Department and the Attorney-General had ruled that pledge warrants issued under the Simmer law for the building of municipal utility plants must be qualified under the provisions of the securities act. The Ballard-Hassett Company then questioned the ruling of the Attorney-General, but it has been sustained by Judge F. S. Shankland in the Polk County, Iowa, District Court. The court maintained that the order of the securities department was justified and clearly within the intent and spirit of the law.

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Plant Sought for Chelsea

Petition has been filed by the city of Chelsea with the Massachusetts Department of Public Utilities requesting a hearing in order to determine the price to be paid for existing lighting properties of the Boston Edison Company, which now serves the city.

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Condemnation Suit Filed

Western Public Service Company has begun suit to enjoin the city of Mitchell, Neb., from delivering $39,000 worth of bonds recently issued to finance payment of company's light and power property taken under condemnation proceedings (ELECTRICAL WORLD, April 21, page 598). The company charges unlawful conspiracy.

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Municipal Survey Defeated

Movement to build a municipal light plant in East Cleveland was recently blocked when the city commission voted against a proposed ordinance to employ an expert to make a preliminary survey. East Cleveland is served by the Cleveland Electric Illuminating Company.

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Mason City Vetoes Plant

By a vote of three to two, City Council of Mason City, Iowa, has vetoed a motion to hold a special election to consider a proposition for the construction of a municipal light and power plant.

FINANCIAL · · · BUSINESS

Opinions Clash on Investor Outlook

Future of utility securities draws contrasting opinions from D. E. Lilienthal and E. K. Woodworth at Mutual Savings Bank Conference. Value of federal operation questioned by banker. Record of private management challenged.

Sharply contrasting views on the future of public utility securities under New Deal power competition and the present public attitude were expressed this week by David E. Lilienthal, director of the Tennessee Valley Authority, and Edward K. Woodworth, president of the New Hampshire Savings Bank. The occasion was the annual conference of the National Association of Mutual Savings Banks, held in New York.

"Limited operation of a public power system will set up a precedent of trusteeship in this business which will have a sound effect upon the financial policies of private utilities," Mr. Lilienthal held. He severely arraigned the financial policies of utility holding company managements. He asserted that a sapping of senior security values, amounting almost to "confiscation," had resulted from the policies of "a small management group with little of their own money at stake."

"We have been given a national power policy to execute in the Tennessee Valley. Under this new policy prudent investment in useful property will not only be respected but protected." — DAVID E. LILIENTHAL.

Traces causes of investor apprehension

Urging his fellow bankers to "combat the idea that public ownership is the universal panacea," Mr. Woodworth struck a note of warning on the effect of governmental construction and operation of power developments. Among the causes tending to create apprehension toward utility securities, Mr. Woodworth listed the following: "Disclosures of abuse of power and misconduct by a few men in high places in the industry; a resulting resentment which has shown itself in demands for lower rates, higher taxes and municipal ownership; assaults for political purposes by those who believe they never lose votes by attacking the local utility company, and, finally, the activities of the federal government in the Tennessee Valley and elsewhere involving the expenditure of vast sums of money in power developments in territories already oversupplied with generating capacity."

Views on T.V.A. benefits conflict

Widely divergent views on the effect of operations on utility securities were expressed by Mr. Lilienthal and Mr. Woodworth. T.V.A. power operations will serve to enhance rather than depress private utility security values claimed Mr. Lilienthal.

"We have been given a national power policy to execute in the Tennessee Valley," he said. "It is intended to serve as a demonstration and an experiment. It answers an overwhelming public demand, after a decade of experience injurious to both investors and consumers. Under this new policy prudent investment in useful property will not only be respected but protected. To avoid duplication of facilities, to avoid territorial competition, to buy property at fair prices, are cardinal policies of the Tennessee Valley Authority. Our adherence to these policies should reassure you of the authority's determination to respect prudent investment in useful property."

"We are painfully aware of the depreciation in the market value of various bonds in our portfolios. Bonds of companies within the sphere of influence of the T.V.A. are but conspicuous examples."— EDWARD K. WOODWORTH.

Holds T.V.A. responsible

While conceding that the ultimate result of T.V.A. and other government operation might be of benefit to utility issues, Mr. Woodworth maintained that "at the moment we are painfully aware of the depreciation in the market value of various bonds in our portfolios. Bonds of companies within the sphere of influence of the T.V.A. are but conspicuous examples of many issues in which we have invested the money of our depositors. Future hopes should not be set up as present standards when private capital, especially trust funds, is taking all the risk.

"To some of us it seems contrary to what we have been brought up to believe are sound American principles for the federal government to invade the utility field, at least without making adequate provision for all damage suffered by those who have invested their money in good faith in properties which have been reasonably well managed. Without the assurance of fair play, the industry will find it difficult, if not impossible, to raise the capital for the necessary expansion of facilities if we are to achieve 'the larger and better use of electric power by the whole people.' for which the chairman of T.V.A. has expressed the hope in his recent report to the President."

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Cities Service Stock Voided in Bay State

Installment sales of Cities Service stock by Henry L. Doherty & Company in Massachusetts in 1927-28-29, without approval of the State Public Utilities Commission, were void. This was ruled last week by Federal Judge Elisha H. Brewster, whose decision also held that the purchasers were entitled to recover their payments. More than 200 buyers are affected by the decision. Their contract purchases were said to exceed $200,000. The court, however, continued an injunction to restrain shareholders from making further demands on the assumption that an appeal will be taken.

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American Water Works in Trade with Chase

Arrangements were concluded last week for the transfer of several properties between American Water Works & Electric Company and Chase National Bank, owner of the Virginia Public Service Company and the Eastern Shore Public Service Company. The Potomac Edison Company, a subsidiary of American Water Works, has acquired the Potomac Valley Power Company with the utility systems serving Harpers Ferry and Glenville, W. Va.; Strasburg, Va., and Barton, Antietam, Emmettsburg, Lonaconing and Midlands, Md. The transfer involves 6,800 customers.

The Loudoun Light & Power Company, formerly an American Water Works property, serving 1,187 customers in Loudoun County, Virginia, has been transferred to Virginia Public Service. In the transfer the Virginia and West Virginia properties were exchanged for the Loudoun company on an even basis.

The Maryland properties sold by the Eastern Shore Company brought about $500,000, while the Maryland properties of the Virginia company transferred to Potomac Edison were sold for more than $100,000.

WHICH WAY?

Liberal discount of a seasonal business recession may be concluded from the three-week decline of stock prices. There have been other factors—exchange regulation and an NRA crisis—to complicate the markets' prediction of events to come, however. Statistical evidence of a spring-peak passed is beginning to appear. Wheat crop damage may reduce some rural buying power.

Energy production for the week ending May 12 indicated a resumption of its upward trend. Steel activity continues higher. Carloadings are off slightly, automobile production reduced as inventories and dealers' stocks rise. Retail sales and light industry activities are weaker. General indexes show some declines. Commodity prices, led by wheat, are notably stronger.

Too many factors, political, financial and psychological, are all tending to produce better business to permit prolonged or major retrogression in trade activity at this time.

Iowa Electric to Issue $1,168,800 Bonds

Iowa Electric Company has filed with the Federal Trade Commission a securities registration statement for an issue of $1,168,800 first mortgage collateral convertible bonds. The issue will be made under a readjustment plan and will be in effect an exchange of old bonds for new. The company has outstanding $1,168,800 first mortgage 6 per cent gold bonds due July 1, 1934, payments on which, it reports, it will not be able to meet. In lieu of these bonds it proposes to issue the new first mortgage collateral convertible bonds. Holders of the 1934 gold bonds will be asked to deposit them and to accept in exchange the new convertible bonds due in 1939. They will be convertible into first lien and refunding 6 per cent bonds which will be due in 1959.

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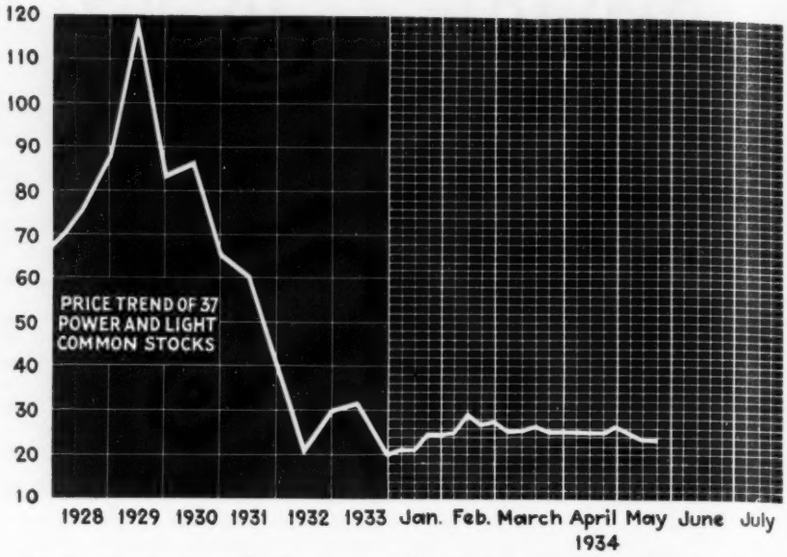
General Electric to Exhibit at the 1934 World's Fair

The "House of Magic" will again be featured by the General Electric Company at its exhibit at the Century of Progress Exposition at Chicago this summer. One of the practical products, to be featured in the display in the great hall of the Electrical Building, will be sodium vapor lighting, introduced last year as a laboratory accomplishment.

Carrying the scientific demonstration idea farther than last year, General Electric will introduce a new method of displaying its finished products. In each section of the exhibit, which will become a series of demonstration rooms with moderate seating capacity, lecturers will demonstrate some experiment in pure science which was the forerunner of the modern electrical device. For example, laboratory developments in the field of air conditioning will be shown in their relation to the modern heating, cooling and air-conditioning devices now marketed.

To take advantage of experience gained last year, emphasis will be placed on the electric kitchen and laundry. Besides scientific lectures on electrical kitchen equipment, a cooking school will be established. Two complete electric kitchens and an electric home laundry will also be installed.

Utility Stocks Yield Ground



Entering the fourth week of general market declines, securities showed rallying tendencies. The *Electrical World* index, however, touched 23.5, as compared with 23.8 last week.

Square D Increases Profit for First 1933 Quarter

Net profit of $82,652 for the first quarter of 1934 was reported this week by the Square D Company, Detroit. The profit, after taxes, depreciation and other charges, is equal to 82 cents a share on 100,228 shares of class A stock, which are entitled to preferential yearly dividends of $2.20. This compares with $90,156, or 36 cents a share, on 71,664 class B shares in the first 1933 quarter.

Current Earnings Reports of Electric Light and Power Companies

Operating Companies

	1934	1933	Per Cent Increase	Operating Ratio 1934	Operating Ratio 1933
Brooklyn Edison (Year ended March 31)					
Gross earnings	$45,291,651	$46,956,994	— 3.5	68	65
Net earnings	14,241,227	16,223,137	—12.2		
Net balance	11,165,765	13,254,479	—15.7		
Cleveland Electric Illuminating (Year ended March 31)					
Gross earnings	22,319,126	23,051,391	— 3.2	69	68
Net earnings	6,930,461	7,321,166	— 5.3		
Net balance	4,117,397	4,553,592	— 9.5		
Duquesne Light (Year ended February 28)					
Gross earnings	24,208,574	24,647,096	— 1.8	45	44
Net earnings	13,269,392	13,847,288	— 4.2		
Net balance*	10,693,071	11,362,301	— 5.9		
Milwaukee Electric Railway & Light (Year ended March 31)					
Gross earnings	24,919,367	24,642,727	1.1	80	82
Net earnings	4,729,999	4,303,930	9.9		
Net balance	207,565	282,071†	.....		
Ohio Edison (Year ended March 31)					
Gross earnings	15,166,340	14,836,987	2.2	50	48
Net earnings	7,516,809	7,630,461	— 1.5		
Net balance	1,759,660	1,951,108	— 9.8		
Puget Sound Power & Light (Year ended March 31)					
Gross earnings	12,707,002	13,058,358	— 2.7	66	61
Net earnings	4,305,744	5,090,112	—15.4		
Net balance	1,440,775†	18,242	.....		
Virginia Electric & Power (Year ended March 31)					
Gross earnings	14,749,364	14,981,911	— 1.5	68	64
Net earnings	4,737,991	5,380,352	—11.9		
Net balance	1,656,204	2,303,981	—28.1		

Holding Companies

	1934	1933	Per Cent Increase	Operating Ratio* 1934	Operating Ratio* 1933
American Gas & Electric and subsidiaries (Year ended March 31)					
Gross earnings	$64,762,553	$63,108,590	2.6	55	53
Net balance	7,829,293	8,389,625	— 6.7		
American Light & Traction and subsidiaries (Year ended March 31)					
Gross earnings	35,279,703	36,985,411	— 4.6	71	70
Net balance	4,489,547	6,335,945	— 15.9		
American Water Works & Electric and subsidiaries (Year ended March 31)					
Gross earnings	43,715,592	41,958,612	4.2	55	55
Net balance	2,455,311	1,762,622	39.3		
Columbia Gas & Electric and subsidiaries (Year ended March 31)					
Gross earnings	76,192,387	76,853,004	— 0.8	70	67
Net balance	5,904,631	9,959,131	— 40.7		
Engineers Public Service and subsidiaries (Year ended March 31)					
Gross earnings	42,623,906	44,640,306	— 4.5	67	62
Net balance	1,308,268†	1,201,804	—209.0		
United Gas Improvement and subsidiaries (Year ended March 31)					
Gross earnings	108,155,135	111,639,988	.....	55	55
Net balance	28,511,203	30,496,379	.....		

*Available for all dividends. †Deficit.

Gross earnings—(Operating Companies) Gross operating revenue. (Holding Companies) Gross operating revenue plus other income. Net earnings—Earnings after deduction from gross earnings of operating expenses taken to include taxes, depreciation, maintenance, operating, etc. Net balance—Balance available from income for common stock dividends.

Westinghouse Announces 1934 Chicago Exhibit

"Electrical visions of 1934" will feature the Westinghouse Electric & Manufacturing Company's exhibit this year at the Chicago Century of Progress Exhibition. The exhibit will be lodged in the southern wing of the Hall of Electricity. Exhibits will demonstrate the generation and distribution of electricity, its control, its application to the home, to transportation and to industry, as well as research laboratory developments. One section of the exhibit will be filled with equipment representing that available today, while another will consist of the research facilities that point to the developments of the future.

A merchandising exhibit will include an eleven-minute dramatic presentation of home electrification. Air-conditioning equipment will be displayed, from the smallest room units to the larger commercial installations. Power and its distribution will be portrayed by an operating model of a waterwheel generator which will provide power for lighting under-water lights in its own display. Electronics will be featured by an enlarged triode tube and a display of thermionic tube-powered sheet-metal welding. A lighting display will show in one bank the 400 "Mazda" standard bulbs. Central-station applications will be popularized by a 230,000-volt lightning arrester and the Deïon circuit breaker. Applications of electricity to industrial processes will provide another display to the exhibit. Research demonstrations will be conducted on the mezzanine floor with many new features not shown last year.

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T.V.A. Buys Insulators

Corning Glass Works has received an order for 18,000 "Pyrex" suspension insulators and a large quantity of suspension and strain clamps from the Tennessee Valley Authority. The order will involve five carloads of material.

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Norge April Shipments Set New Sales Record

With the shipment of 26,402 electric refrigerators in April, Norge Corporation reports that it has exceeded its best previous month's record by 6,404 units. Unfilled orders on hand at the end of the month totaled 34,360. Total orders for the first four months of 1934 exceeded total shipments for the entire year of 1933 by 11 per cent, according to Howard E. Blood, the corporation's president.

"April deliveries were approximately 2½ times those of the same month last year," said Mr. Blood. "This record was accomplished directly following the record-breaking month of March, when 19,988 units were shipped. Our factories are running at capacity and there is no apparent slackening in demand."

New York Metal Prices

	May 8, 1934 Cents per Pound	May 15, 1934 Cents per Pound
Copper, electrolytic	8.50*	8.50*
Lead, Am. S. & R. price	4.25	4.25
Antimony	8.70	8.60
Nickel ingot	35.00	35.00
Zinc, spot	4.70	4.70
Tin Straits	54.00	53.00
Aluminum, 99 per cent.	23.30	23.30

*Blue Eagle

SALES OPPORTUNITIES IN NEW CONSTRUCTION

Spot coverage of the week. Projects approved and proposed, bids requested, equipment wanted, funds available. Prospects for the electrical manufacturer.

Cleveland, Ohio—Steel & Tubes, Inc., plans installation of heavy-duty motors and controls, regulators, electric traveling crane equipment, etc., in proposed addition. Appropriation of $200,000 is being arranged.

Philadelphia, Pa.—Container Corporation of America, Inc., plans addition to power plant, with installation of new turbo-generator unit and accessories. Plans being drawn.

Fort Peck, Mont.—United States Engineer Office, Kansas City, Mo., asks bids until May 31 for electric distribution system for No. 7 circuit and dredge feeders at site of proposed Fort Peck dam, including quantity of wood poles, 30 to 65 ft. long, one steel switching structure, six steel suspension towers, four steel anchor towers, 1,011,000 lb. conductor cable hollow copper, 43,500 lb. conductor cable copper, 224,400 lb. conductor cable concentric composite, insulators, line hardware, etc. (Circular 120).

Corpus Christi, Tex.—Corpus Christi Refining Company plans installation of motors and controls, air compressors, electric pumping machinery, etc., for new gasoline refining plant. Cost over $200,000.

Kalamazoo, Mich. — City plans installation of lighting system on number of main streets. Cost about $60,000.

Benson, Minn.—City takes bids early in June for extensions and improvements in city-owned electric light and power plant, including boiler, superheater, stokers, etc. Fund of $50,000 has been arranged.

Lawrenceburg, Ind.—James Walsh & Company, distillers, plan power plant at new local distillery; motors and controls, regulators, conveyors, pumping equipment, etc., will be installed. Cost about $400,000.

Los Angeles, Calif.—Bureau of Water and Power asks bids until May 25 for sixteen 34,500-volt motor-operated oil circuit breakers and one tank-lowering device (Specification 1419).

Chillicothe, Ohio—Chillicothe Paper Company plans extensions and improvements in power plant, with installation of additional equipment.

Yellville, Ark.—General Mining Corporation plans installation of heavy-duty motors and controls, elevating and conveying equipment, loaders, electrolytic smelting machinery and other equipment at zinc and lead mining properties and proposed new smelting plant. Cost over $150,000.

San Francisco, Calif.—Wieland Brewing Company plans extensions and improvements, with installation of new equipment. Cost about $150,000.

Buffalo, N. Y. — Board of Public Works will make surveys for city-owned electric light and power plant in conjunction with municipal water pumping station, including transmission circuit and distribution lines for street-lighting and public buildings. Estimated cost $500,000.

Spokane, Wash.—Bureau of Reclamation, office of Columbia Basin Commission, Civic Building, asks bids until June 5 for construction of Grand Coulee Dam and power plant, Columbia River Basin Project, Wash. Three initial power units are planned, each of 105,000 kw. capacity. (Equipment will be purchased under another contract.)

Mount Vernon, Mo.—City soon asks bids for addition to city-owned electric light and power plant, including Diesel engine unit and auxiliary equipment.

Cushing, Okla.—Cushing Refining & Gasoline Company plans installation of motors and controls, air compressors, pumping machinery and other equipment for new gasoline refining plant. Cost about $100,000.

Chicago, Ill.—Allen B. Wrisley Company plans installation of motors and controls, conveyors, etc., in new addition to soap-manufacturing plant. Cost about $50,000.

Edgewood Arsenal, Md. — Procurement Officer, Chemical Warfare Service, asks bids until June 5 for one electric furnace (Circular 73).

Escanaba, Mich. — Escanaba, Iron Mountain & Western Railroad will install electric traveling cranes, electric hoists, loaders and other material-handling equipment at new ore dock, North Escanaba. Fund of $3,500,000 has been arranged through Federal aid.

Strong City, Kan.—City has secured fund of $53,000 through federal aid for new city-owned electric light and power plant and plans early construction.

Wausau, Wis. — Marathon Paper Mills Company, Rothschild, Wis., plans installation of motors and controls, regulators, conveyors, hoists, etc., in new paper converting plant at Wausau, where existing building will be remodeled and equipped. Cost $50,000.

Portland, Ore.—United States Engineer Office asks bids until June 26 on two 60,000-hp. Kaplan turbines and governing equipment for Bonneville Dam.

Hannibal, Mo. — Board of Public Works will receive bids covering installation of one 7,500-kw. steam turbine-generator together with surface condenser and auxiliary equipment until June 4.

MEN OF THE INDUSTRY

Dr. Langmuir Awarded Franklin Medal

Dr. Irving Langmuir has been made one of the recipients of the Franklin medal of the Franklin Institute of Philadelphia. The award is in recognition of his investigations in physics and chemistry carried on in the research laboratories of the General Electric Company, of which

he is associate director. Dr. Langmuir entered the G. E. research laboratories in 1909 after spending three years on the teaching staff of the Stevens Institute of Technology. His outstanding achievement is his invention of the nitrogen-filled incandescent electric light bulb. This improvement has reduced by 50 per cent the cost of more than half the electric current bought in the United States for lighting purposes. He has also carried out successful work on the vacuum lamp and on radio tubes.

Scientific honors have frequently been bestowed upon Dr. Langmuir. He received the Nobel prize for outstanding achievements in chemistry in 1932 and in that same year was the winner of the *Popular Science Monthly* annual award of $10,000 for notable scientific achievement. Twice he was awarded the Nichols medal by the New York section of the American Chemical Society. Other awards include the Hughes medal of the Royal Society of London, the Rumford medal of the American Academy of Arts and Sciences and the Cannizaro prize of the Royal Academy of Lincei, Rome, Italy.

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C. H. E. Williams was elected president of the Vancouver Electrical Association at the recent annual meeting.

R. W. Carpenter has been appointed division manager of the Idaho Power Company at Twin Falls. He succeeds J. D. Orr, who has assumed new duties in Boise.

Dr. Hugh S. Magill is relinquishing the presidency of the American Federation of Utility Investors, Inc. This association was recently formed by investors in public utility securities to combat present destructive forces. The directors of the federation have not yet set a date for a meeting at which they will act on Mr. Magill's resignation and there has been no discussion of a successor.

George L. See has been elected president of the Illinois Manufacturers' Costs Association. Mr. See is supervisor of accounts of the Western Electric Company.

John Wisdom, vice-president and general manager of the West Tennessee Power & Light Company, Jackson, has been elected president. As chief executive of the West Tennessee utility Mr. Wisdom is succeeding the late W. D. Kyser.

Victor E. Hulett has been appointed manager of the eastern division of the Wisconsin Power & Light Company with headquarters at Fond du Lac. Mr. Hulett was formerly connected with the Public Service Company of Northern Illinois.

C. J. McNamara has been named to head the survey work for the Sutherland irrigation project in the North Platte section of the state of Nebraska. Mr. McNamara prepared the preliminary engineering studies for this undertaking before its acceptance by the government. He is a member of the engineering firm of McNamara & Nosky.

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Fred Karr, new president of the Missouri Association of Public Utilities, is also president of St. Joseph Gas Company.

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Riley E. Elgen has been elected chairman of the Public Utilities Commission of the District of Columbia. Mr. Elgen has been acting chairman of the commission during the past seven months. **Richmond B. Keech** has been named vice-chairman. Mr. Keech was appointed recently to the commission by President Roosevelt to fill a vacancy created by the resignation of Major General Mason M. Patrick. **William A. Roberts,** who for several years has served as counsel to the commission under assignment by the Corporation Counsel, has been appointed People's Counsel to succeed Mr. Keech.

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L. W. Chubb Receives Ohio State Lamme Medal

Lewis W. Chubb has been awarded the Lamme medal of Ohio State University for his outstanding work in the field of engineering. Announcement was made by Dr. George W. Rightmire, president of the University. Presentation will take place June 11. Mr. Chubb is director of

the research laboratories of the Westinghouse Electric & Manufacturing Company.

Following graduation from Ohio State University, he became identified with the Westinghouse company, where his most noteworthy work was in research in connection with the preparation and properties of magnetic steel. When the radio engineering department was formed in 1920 Mr. Chubb was appointed manager. These duties he relinquished in 1930 to become first assistant to the vice-president in charge of engineering of the Radio-Victor Corporation of America with headquarters in Camden. Six months later he returned to Westinghouse as director of research laboratories.

Mr. Chubb has been active in standardization, both nationally and internationally, and in the committee work of the leading technical societies. He has twice been sent as a delegate of the International Electrotechnical Commission to London and Brussels. His wide experience in many pioneer fields of development work resulted in his being awarded 200 patents in the electrical, mechanical, chemical, electrochemical and welding fields. Mr. Chubb is a fellow of the American Institute of Electrical Engineers.

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W. H. Henry, manager of sales of the fractional-horsepower motor section of the motor division of the industrial department, General Electric Company, is now located at the general office in Schenectady. He will assist C. F. Pittman in the administrative work of the motor division. Mr. Henry was formerly located at the G.-E. works in Fort Wayne, Ind. **A. W. Bartling** has been appointed assistant manager of

sales, fractional-horsepower motor section, with headquarters at Fort Wayne, Ind. **P. O. Noble** has been named engineer and **A. F. Welch** consulting engineer of the fractional-horsepower motor engineering department at Fort Wayne.

T. S. Davis has joined the Georgia Power Company as lighting engineer of the Atlanta division. Mr. Davis was formerly connected with the incandescent lamp department of the General Electric Company.

C. M. Wallace, Jr., has been appointed industrial lighting specialist of the Georgia Power Company. He is succeeding W. J. Riley, resigned. Mr. Wallace was formerly Athens division lighting engineer. **C. H. Burch** has been appointed to succeed Mr. Wallace.

J. D. Orr has been named assistant general manager of the Idaho Power Company. Mr. Orr has been division manager of the company at Twin Falls for the past seven years. His connection with the Idaho utility and its predecessors covers a period of 24 years, during which he served in various managerial positions.

John D. Lockton was elected assistant treasurer of the General Electric Company at the last meeting of the board of directors. Graduated from the University of Michigan in 1926, Mr. Lockton entered the disbursements division of the General Electric accounting department at Schenectady. Two years later he was transferred to the auditing department. In 1932 he became assistant to the treasurer, which position he held when elected assistant treasurer.

OBITUARY

C. W. Price

Charles W. Price, for almost forty years associated with the electrical trade press, died suddenly May 11 in New York, in his seventy-seventh year. At the time of his death Mr. Price was chairman of the board of the International Trade Press and New York manager of The Magazines, Inc. A student of the electrical industry, he took a position in 1885 on the staff of the *Electrical Review*, published in New York, subsequently becoming editor-in-chief and the largest owner. Early in 1922 he retired as editor after spending forty years in the editorial chair.

The *Electrical Review*, over which Mr. Price had presided so long, had been purchased by the McGraw-Hill Publishing Company, which continued to publish it in Chicago, but as a monthly magazine under the title *Electrical Review and Industrial Engineer*. Mr. Price was a member of the American Institute of Electrical Engineers, the old National Electric Light Association, the New York Advertising Club and other societies.

Edson O. Sessions

Edson O. Sessions, for many years prominently identified with the electrcial manufacturing industry, died April 15 in Chicago, following an operation. In recent years Mr. Sessions had been engaged as president of the Sessions Engineering Company, in consulting electrical engineering, particularly in its industrial phases. His association with the electrical industry began in 1889 with the Thomson-Houston Electric Company and continued with the General Electric Company until 1909, in various phases of apparatus development, manufacturing, construction and sale. Following his resignation from the General Electric Company Mr. Sessions established a business for the commercial development of his own inventions. From these activities sprang the Electrical Engineers Equipment Company, the General Devices & Fittings Company and other undertakings for the manufacture and sale of electrical specialties.

In 1931, at the invitation of the Soviet Government, Mr. Sessions spent a number of months in Russia, where he made extensive studies of the electrical aspects of the famous Five-Year Plan. For his contributions to the advancement of the electrical arts he received the degree of doctor of engineering from the Ecole Polytechnique. He was a fellow of the American Institute of Electrical Engineers, a member of the American Society of Mechanical Engineers and an associate member of the American Society of Civil Engineers.

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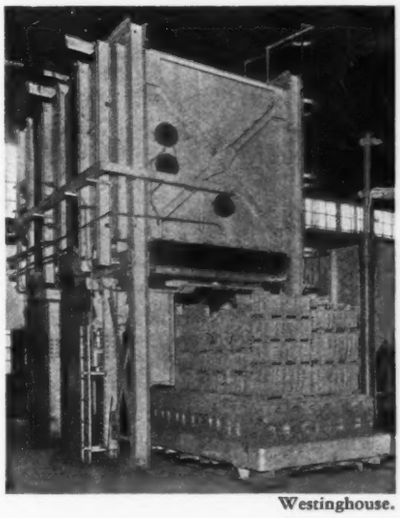
Silas H. Altorfer, president of Altorfer Brothers Company, Peoria, Ill., died May 14 in his fifty-first year. Mr. Altorfer was a pioneer in the washing machine industry. In 1903 he and his brother founded the ABC washing machine business at Roanoke, Ill., their native city. Seven years later the spacious plant was established at Peoria, where the business has progressively grown under Mr. Altorfer's management and guidance.

NEW EQUIPMENT

Short-Cycle Malleablizing Electric Furnaces

Malleablizing furnaces which reduce the heat treatment time from 6, 8 or 10 days to 72 hours or less have been announced by the Westinghouse Electric & Manufacturing Company, East Pittsburgh. Decarburized surfaces, hard skin or hard spots on the surface, picture frame structures, and burned or scaled castings are eliminated by malleablizing based on chemical analysis of the cast iron under controlled electric heat and automatically controlled atmospheres. They are designed for heating the charge at night during off-peak load, with only losses supplied during the day. Sizes range from ½ to 25 tons with maximum night loads of 40 to 600 kw. and daytime 13 to 75 kw. Energy consumption for the 72-hour cycle per gross ton of charge (castings and boxes when required) varies from 775 kw.-hr. for ½-ton size to 375 kw.-hr. for 25-ton size.



Westinghouse.

Such a definite time-temperature cycle depending on the chemical analysis of the iron dictates that each casting must be of highest quality as to tensile strength elongation and machineability for the particular analysis. Any plant with average melting supervision and analysis control can employ the 72-hour cycle successfully, and 26-hour cycles have been obtained by companies having these furnaces in operation on ½-in. castings where the analysis is carefully controlled. Packing materials and heavy cast iron pots are not required and where boxes are needed those of ½-in. sheet steel have been used without scaling for 240 heats.

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Truck Tailgate Elevators Cut Loading Losses

Elevators for handling loads in or out of trucks have been announced by the Davey Compressor Company, Inc., Kent, Ohio. They are identified as Davey-Troel power elevator tailgates and are manufactured under license. The tailgates replace the conventional tailboard and are mounted in a welded frame of structural steel. They are driven by a power take-off from the truck motor by means of cable-operated vertical rams. From 1 to 2 hp. is required to handle normal loads from body level to sidewalk or street in about 60 seconds. The speed can be varied within limits by merely varying truck motor speed.

The units are advantageous for moving heavy appliances, transformers, large castings, etc., and will eliminate much loss from dropping of equipment or injury to men from lifting or loading accidents. When ready to unload, the tailgate is lowered from its traveling vertical position to a horizontal position flush with the floor of truck, where it is held by chains.

After being loaded it is lowered under constant control by means of control lever at the rear of the truck. Elevator can be stopped at any point either up or down.

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Cables for Mine Service

Armored type telephone cable, 600-volt service cable and low-voltage cable, all designed for mining service, have been announced by the General Electric Company, Schenectady. The armored type telephone cable resists extreme hazards by means of a galvanized-steel interlocking armor of the same type as on G.E. type BX armored cable. An application of asphalt and jute over and under the armor protects it from deterioration. A lead sheath protects it from moisture. A special rubber compound of low capacity facilitates its use in telephone communication.

The 600-volt cable is a tellerium-compounded all-rubber mining cable jacketed in heavy rubber similar to tire treads, to protect it when being dragged behind machinery and exposed to construction hazards. The low or medium voltage cable is meant for motor leads, leads for controls devices, coils, etc. It is insulated with Glyptal cloth employing a synthetic resin. It is unaffected by oil or gasoline, withstands high temperatures and is tough and flexible.

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Plug fuses of high visibility have been introduced by the Chase-Shawmut Company, Newburyport, Mass. By the use of black links against a white interior background the condition of the fuse can be seen at all angles, the gap resulting from a "blow" standing out conspicuously at the narrowed portion of the link. The line is known as the "Blac-Link" design.

Bi-post base 3-kw. airport lamps have been announced by the Incandescent Lamp Department of the General Electric Company, Nela Park, Cleveland, and the Westinghouse Lamp Company, Bloomfield, N. J. The new "Mazda" airport floodlight lamps for 32-volt operation have a T-32 bulb with bi-post base to supersede the GT-38 with prong base. They have a light center length of 5¾ and an over-all length of 14 in. Increased ruggedness, decreased weight and a more accurate positioning of the source with relation to reflectors or lenses are features that have been achieved through the application of the bi-post design to these airport lamps.

Three-lite lamps for indirect portables have been announced by the Westinghouse Lamp Company, Bloomfield, N. J. These new "Mazda" lamps have filaments for 100, 200 or 300-watt consumption. The 100-watt filament will light a living room, the 200 is sufficient for reading and the two combined will provide enough light for bridge or other indoor games. The lamps are similar to the single-filament 250-watt "Mazda Indirect-lite" lamps introduced last fall, both having G-30 inside-frost bulbs. New features are a mogul screw base and the slight increase of ¼ in. in both over-all and light center lengths to 6¾ and 3¾ in. respectively. The base has a double contact with the 200-watt filament connected to the center, or contact button and the 100-watt filament connected to the ring contact surrounding it. Experiments at Bloomfield have shown that a round-bulb lamp such as the G-30 used with bowl type reflector will give 85 per cent efficiency as compared with the average of 50 per cent in existing types of indirect portables.

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Small "Care-Free" Motors

Care-free capacitor motors designed especially for refrigerators are being featured by the General Electric Company, Schenectady. These type KC motors are mounted in live rubber treated to make it impervious to oil and are fractional-horsepower motors without objectionable noise caused by torque vibration and by endwise and radial out-of-balance. Other features include an end-play silencer eliminating end-play

General Electric Co.

noise by cushioning rotor oscillations in either direction, an optional belt tightener which maintains sufficient tension, proportional to the load, to prevent slippage, and a cast rotor of solid aluminum formed by high-pressure casting assuring balance and permanent electrical characteristics. Large oil capacity with improved, wool-packed bearings, oil throwers and returns to conserve lubricant are provided. Lubrication is required only once a year.

Built-in terminal box eliminates the necessity for splicing and soldering leads. Three binding posts are provided for direct connection of the line and cold-control leads. To protect the motor from falling dirt and water drip-proof end shields have been used.

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Streamline design electric drills in the ¼-in. size have been announced by Black & Decker Manufacturing Company, Towson, Md. The drills are similar to the ¼-in. size introduced some time ago and are styled to be modern as well as balanced for ease of handling. The motor power has been increased 33⅓ per cent over previous models, anti-friction bearings are used throughout, with armature and chuck spindle mounted on ball bearings. The switch handle is entirely new. Universal motors are used and can be furnished for all voltages. The weight is only 5¾ lb.

ENGINEERING DATA FROM MANUFACTURERS

Bulletins and catalogs now available to engineers by manufacturers and associations

Heater Switches, Bulletin No. 11-A of the Hart Manufacturing Co., Hartford, Conn., 22 pages. Covers Diamond H heater switches, thermostats, and other control devices, for electric ranges, water heaters and similar appliances; gives complete data and prices, together with wiring plans and dimensional drawings.

Type RD Motors direct current, compound wound, Bulletin 167, Part 8 of the Wagner Electric Corporation, 6400 Plymouth Ave., St. Louis, 4 pages, April 1934. Describes with illustrations the construction operation and applications of Wagner Type RD d.c. motors available in fractional and 1 hp. sizes.

Worthington Refrigeration Compressors of the horizontal duplex type, Leaflet L-612-S28 of the Worthington Pump and Machinery Corporation, Harrison, N. J. Describes with illustrations and sectional drawings Worthington refrigeration compressors of this type single or two-stage for direct or belt-driven operation.

Crane Engineering Illustrated, new quarterly of the Whiting Corporation, Harvey, Ill., 8 pages, spring, 1934. Illustrated applications and useful information on the application of traveling cranes to industrial work.

Squirrel Cage Induction Motors, the full measure motor, Leaflet 2173 of the Allis-Chalmers Manufacturing Company, Milwaukee, 4 pages, April, 1934. Presents, with illustrations of parts and sectional views, the distinctive features of Allis-Chalmers type AR squirrel-cage induction motors for flange mounting and of the vertical and drip-proof types.

Groundometers for the direct reading of the resistance of earth electrodes, Bulletin 130 of the Borden Electric Company, Summit, N. J., 8 pages, May, 1934. Discusses the type GU Groundometer, its accessories and method of performing tests, together with sketches, illustrations and prices.

Tripplastic Semi-Metallic Packing, Catalog of Wm. B. Merrill & Company, Boston, Mass. Indicates the physical properties of Tripplastic packings and end rings, the types available, manufacturer's recommendations for different services and sectional installation illustrations.

Direct-Current Generators and Exciters, type B, Bulletin GEA-1607A of the General Electric Company, Schenectady, N. Y., 4 pages, April, 1934. Describes and illustrates the parts and construction features of General Electric Type B d.c. motors for 125 or 250-volt service, including ventilation and control rheostats.

Brown Thermometers and Pressure Gages, Catalog No. 6702 of the Brown Instrument Company, Philadelphia, Pa., 80 pages. Illustrations of the different types and sizes of Brown thermometers, pressure and vacuum gages, liquid level gages, hygrometers and their accessories, together with construction features and application helps.